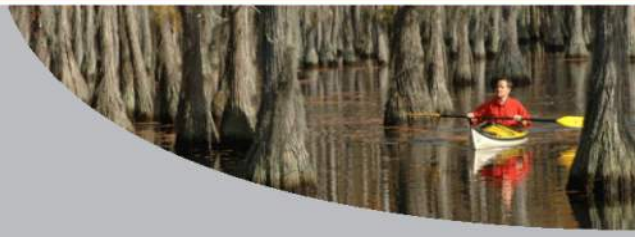
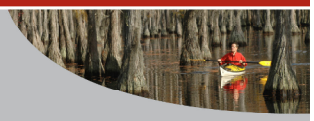

# REGIONAL WATER PLAN

June 2017

# TABLE OF CONTENTS





## Table of Contents

## Tables



## Figures



## Supplemental Documents

The following supplemental materials have been developed in support of the Altamaha Regional Water Plan and are available electronically as attachments to the Regional Water Plan at www.altamahacouncil.org:

- Public Outreach Technical Memorandum
- Vision and Goals Technical Memorandum
- Water and Wastewater Forecasting Technical Memorandum
- Gap Analysis Technical Memorandum
- Management Practices Selection Process Technical Memorandum
- Plans Reviewed in Selecting Management Practices Technical Memorandum
- Water Conservation Technical Memorandum

## Acknowledgments

The Atlamaha Council should be acknowledged for contributing significant amounts of time and talent toward the development of the Regional Water Plan. They participated in council meetings, subcommittee meetings, conference calls, and report development and review. The members of the Altamaha Council include:

| Name | City | County |
|---|---|---|
| Gary Bell | Claxton | Evans |
| Randy Branch (Alternate) | Baxley | Appling |
| Guy R. Bullock | Pitts | Wilcox |
| James M. Burns | Tarrytown | Montgomery |
| Gerald A. DeWitt (Alternate) | Jesup | Wayne |
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| Michael Williams | Cochran | Bleckley |
| Russ Yeomons | Swainsboro | Emanuel |
| Representative Greg Morris (Ex-Officio) | - | - |
| Senator Tommie Williams (Ex-Officio) | - | - |

The Altamaha Council would like to thank Rick Brown and Danielle Honour with CDM Smith and Jennifer Welte of Georgia EPD for providing the planning and technical guidance toward the development of this Plan.

## Conversion of Units (Water Flow and Volume) Used in Plan (values rounded)

1 cubic foot = 7.48 gallons

1 cubic foot per second = 0.646 million gallons per day or 646,272 gallons per day

1 million gallons per day = 1.55 cubic feet per second

1 million gallons = 3.069 acre-feet (1 acre-foot is enough water to cover a football field with about 9 inches of water)

1 cubic foot per second = 1.98 acre-feet per day

1 acre-foot = 325,851 gallons

1 acre-foot = 0.326 million gallons

## List of Acronyms

| | |
|---|---|
| AAD-MGD | Annual Average Day in million gallons per day |
| ASR | Aquifer Storage and Recovery |
| ASWS | Additional/Alternate Surface Water Supply |
| BMP | best management practice |
| cfs | cubic feet per second |
| CRD | Coastal Resources Division |
| CWA | Clean Water Act |
| CWCS | Comprehensive Wildlife Conservation Strategy |
| CWSRF | Clean Water State Revolving Fund |
| DCA | Department of Community Affairs |
| DCAR | Data Collection/Additional Research |
| DNR | Department of Natural Resources |
| DO | dissolved oxygen |
| DWSRF | Drinking Water State Revolving Fund |
| EDU | Educational Needs |
| EPA | U.S. Environmental Protection Agency |
| EPD | Environmental Protection Division |
| ET | evapotranspiration |
| FERC | Federal Energy Regulatory Commission |
| GEFA | Georgia Environmental Finance Authority |
| Georgia DOA | Georgia Department of Agriculture |
| GFC | Georgia Forestry Commission |
| gpcd | gallons per capita per day |
| GSWCC | Georgia Soil and Water Conservation Commission |

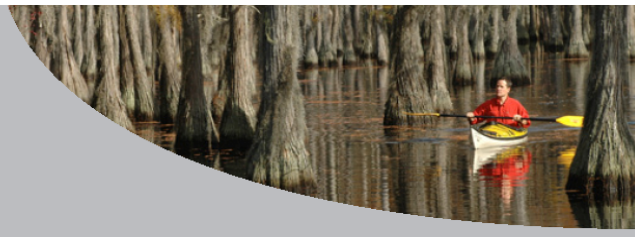
## List of Acronyms

| | |
|---|---|
| GW | groundwater |
| I/I | inflow and infiltration |
| IGWPC | Industrial Groundwater Permit Capacity |
| IWWPC | Industrial Wastewater Permit Capacity |
| LAS | land application system |
| LDA | local drainage area |
| M | million |
| MG | million gallons |
| MGD | million gallons per day |
| MGWPC | Municipal Groundwater Permit Capacity |
| MNGWPD | Metropolitan North Georgia Water Planning District |
| MOA | Memorandum of Agreement |
| MWWPC | Municipal Wastewater Permit Capacity |
| N/A | not applicable |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | non-point source |
| NPSA | Agricultural Best Management Practices |
| NPSF | Forestry Best Management Practices |
| NPSR | Rural Best Management Practices |
| NPSU | Urban Best Management Practices |
| NRCS | Natural Resources Conservation Service |
| NUT | nutrients |
| O.C.G.A. | Official Code of Georgia Annotated |
| OCP | Ordinance and Code Policy |

## List of Acronyms

| | |
|---|---|
| OPB | Office of State Planning and Budget |
| OSSMS | on-site sewage management systems |
| PIP | Public Involvement Plan |
| PS | point source |
| PSDO | Point Sources – Dissolved Oxygen |
| $mi^2$ | square miles |
| SW | surface water |
| TMDL | total maximum daily load |
| UGA | University of Georgia |
| USDA | U.S. Department of Agriculture |
| USFS | U.S. Forest Service |
| USGS | U.S. Geological Survey |
| WC | water conservation |
| WCIP | Water Conservation Implementation Plan |
| WRD | Wildlife Resources Division |
| WTP | water treatment plant |
| WWTP | wastewater treatment plant |

# EXECUTIVE SUMMARY



# Executive Summary

### *Introduction and Overview of the Altamaha Region*

Of all Georgia's natural resources, none is more important to the future of our State than water. Over the last several decades, Georgia continues to be one of the fastest growing states in the nation. According to the U.S. Census Bureau, between 2010 and 2016, Georgia ranked 4th in total population gain (0.6 million new residents) and 12th in percentage increase in population (6%). During a portion of this same period, our State also experienced critical areas of severe drought. Georgia's growth and economic prosperity are vitally linked to our water resources.

As our State has grown, the management and value of water resources have also changed. Ensuring a bright future for our State requires thoughtful planning and wise use of our water resources. The water planning process began in 2008, when the State of Georgia's leadership authorized a comprehensive state-wide water planning process to help address these challenges and take a forward look at how our State is expected to grow and use water through 2050. The Altamaha Regional Water Planning Council (Altamaha Council) was established in February 2009 as part of this state-wide process. The Altamaha Council completed the initial Regional Water Plan in 2011, and in 2016-2017 the Altamaha Council updated the Regional Water Plan. The Altamaha Council is one of 11 planning regions charged with developing Regional Water Plans, and encompasses 16 counties in the south central portion of Georgia (shown in Figure ES-1). An overview of the updated findings and recommendations for the Altamaha Region are provided in this Executive

## Water Resource Trends and Key Findings for the Altamaha Region

*The Altamaha Region includes 16 counties in the south central portion of Georgia. Over the next 35 years, the population of the region is projected to increase from approximately 256,000 to 285,000 residents.*

*Key economic drivers in the region include agriculture, forestry, professional and business services, education, healthcare, manufacturing, public administration, fishing and hunting, and construction. Energy production is also significant to the region. Water supplies, wastewater treatment, and related infrastructure will need to be developed and maintained to support these economic drivers.*

*Groundwater (the majority from the Floridan aquifer) is forecasted to meet about 70% of the water supply needs, with agricultural and industrial uses being the dominant demand sectors. Surface water is utilized to meet about 30% of the forecasted water supply needs, with agriculture and energy as the dominant demand sectors. The energy sector is a major user of surface water from the Altamaha River.*

*Water resource challenges in the region include: surface water shortfalls during some periods on the Canoochee, Ogeechee, Alapaha, and Satilla Rivers; and water quality challenges associated with low dissolved oxygen in some portions of the region.*

*Management practices are needed to address these challenges including: water conservation; refining planning information; alternate sources of supply in areas where surface water availability may be limited; improving/upgrading wastewater treatment; and addressing non-point sources of pollution.*

Summary. The Altamaha Council's Regional Water Plan is available on the Council's website.

**Figure ES-1: Altamaha Regional Water Planning Council**


Georgia has ample water resources, with 14 major river systems and multiple groundwater aquifer systems. These waters are shared natural resources; streams and rivers run through many political jurisdictions. The rain that falls in one region of Georgia may replenish the aquifers used by communities many miles away. And, while ample water in Georgia is available, it is not an unlimited resource. It must be carefully managed to meet long-term water needs. Since water resources vary greatly across the State, water supply planning on a regional and local level is the most effective way to ensure that current and future water resource needs are met.

The Altamaha River, formed by the confluence of the Ocmulgee and Oconee Rivers, is the major surface water feature in the region. The river originates in the Northern Piedmont province of north Georgia, traverses southeast through the Coastal Plain region, and discharges to the Atlantic Ocean near Darien, Georgia. It is the only major river in Georgia that is contained wholly within the boundaries of the State. The Altamaha River is a popular fishing resource to the region and is home to 74 species of fish including sunfish, largemouth bass, bluegill, black crappie, and catfish.

The Altamaha Region encompasses several major population centers, including Vidalia, Jesup, Swainsboro, Eastman, and Glennville. The Altamaha Region is projected to grow by approximately 29,000 residents, or 11%, from 2015 to 2050 (Georgia's Office of Planning and Budget, 2015). To accommodate this growth, the region requires reliable water supplies and sufficient wastewater treatment to meet its growing needs. In addition, the region has a vibrant agricultural base that requires water supply to continue supporting the economics of the region.

Key economic drivers in the Altamaha Region include agriculture, forestry, professional and business services, education, healthcare, manufacturing, public administration, fishing and hunting, and construction. The important industrial and manufacturing sectors in the region include mining, food, textile, paper, chemical, petroleum, rubber, stone and clay, primary metals, fabricated metals, and electrical equipment. Forested lands and agriculture are major land covers in the region, which are also important drivers for the region's economy.

### *Establishing a Water Resource Vision for the Altamaha Region*

A foundational part of the water planning process was the development of a vision for the region that describes the economic, population, environmental, and water use conditions that are desired for the region. The Altamaha Council adopted the following vision for the region.

*"The vision of the Altamaha Regional Water Planning Council is to wisely manage, develop, and protect the region's water resources for current and future generations by ensuring that the Altamaha basin's water resources are sustainably managed to enhance quality of life and public health, protect natural systems including fishing, wildlife and wildlife utilization activities, and support the basin's economy."*

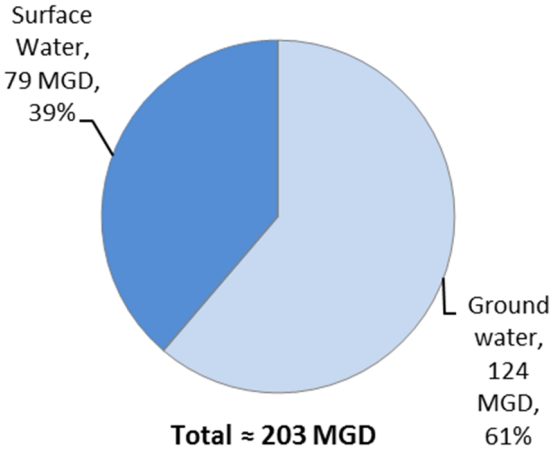
The Altamaha Council identified 12 goals to complement the vision. These goals can be found in Section 1 of the Regional Water Plan.

### *Overview of Water Resources and Use in the Altamaha Region*

#### Surface Water

The Altamaha River is the major surface water feature in the region. The Altamaha River, formed by the confluence of the Ocmulgee and Oconee Rivers, is 127 miles long and has a drainage area of approximately 14,000 square miles (EPD, 2003). As shown in Figure ES-2, surface water is used to meet about 39% of the region's water supply needs. Through 2050, the sources of agricultural surface water in the region are projected to come from the Altamaha River Basin (36%), Ocmulgee River Basin (29%), Ogeechee River Basin (20%), Satilla River Basin (7%), Suwannee River Basin (6%), and Oconee River Basin (2%). This information is based on the assumption that future use will follow current practices and trends. However, as described in more detail below, there are

**Figure ES-2: 2010 Water Supply by Source Type**




Data Source: "Water Use in Georgia by County for 2010; and Water-Use Trends, 1985-2010" (USGS, 2016).

some locations where current and/or future water needs exceed water availability, which causes the need to develop alternate sources of water supply.

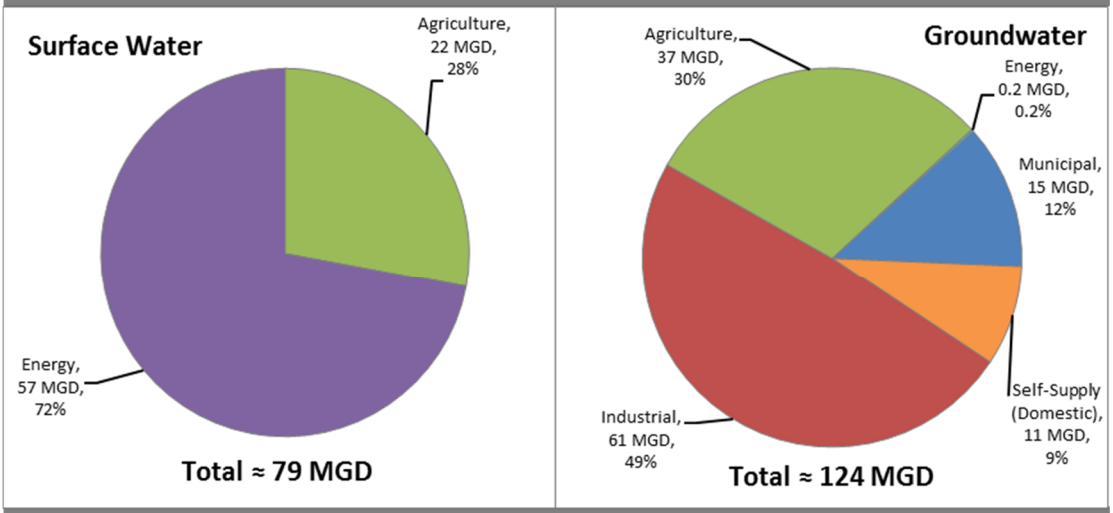
## Groundwater

As shown in Figure ES-2, groundwater is used to meet about 61% of the region's water supply needs. Based on 2015 forecasted groundwater withdrawal data, approximately 96% of groundwater in the region will be supplied from the Floridan aquifer, which is one of the most productive groundwater aquifers in the United States. The remaining groundwater is supplied by the surficial, Claiborne, Gordon, Cretaceous, Dublin and Brunswick aquifers.

### *Water and Wastewater Needs in the Altamaha Region – A Closer Look*

Figure ES-3 presents surface water and groundwater use by sector in the Altamaha Region. About 72% percent of surface water withdrawals in the region are for the energy sector. However, only approximately 35 MGD of the total 57 MGD of energy water withdrawals are consumed, while the remaining 22 MGD are returned to the surface water. About 98 MGD of groundwater withdrawals are used to supply industrial (49%) and agricultural uses (30%), while municipal, self-supply (homes with groundwater wells), and energy make up the remaining uses.

**Figure ES-3: 2010 Water Use by Category**




Data Source: "Water Use in Georgia by County for 2010; and Water-Use Trends, 1985-2010" (USGS, 2016).

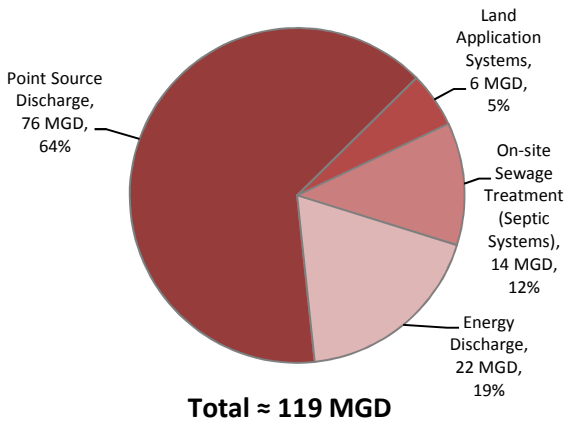
Energy totals shown represent total thermoelectric water withdrawal; 35 MGD of the total 57 MGD (61%) is consumptive, the remainder (22 MGD) is discharged back to surface waters as return flow.

Wastewater treatment types/values representing past trends and forecasted use in the region are shown in Figure ES-4. According to the updated Altamaha Water and Wastewater Forecast developed for the Regional Water Plan (CDM Smith, 2017), 64% of treated wastewater in the region is disposed of as a municipal/industrial point source discharge, energy discharge (19%), or to a land application system (5%). The remaining wastewater is treated by on-site sewage treatment (septic) systems (12%).

### *Altamaha Forecasted Water Resource Needs from the Year 2015 to 2050*

Municipal water and wastewater forecasts are tied to population projections for the counties within the Altamaha Region. The updated population projections were developed by the Georgia Governor's Office of Planning and Budget and are shown in Figure ES-5. Overall, the region's water supply needs are expected to grow by 13% (33 MGD) from 2015 through 2050. Over the same

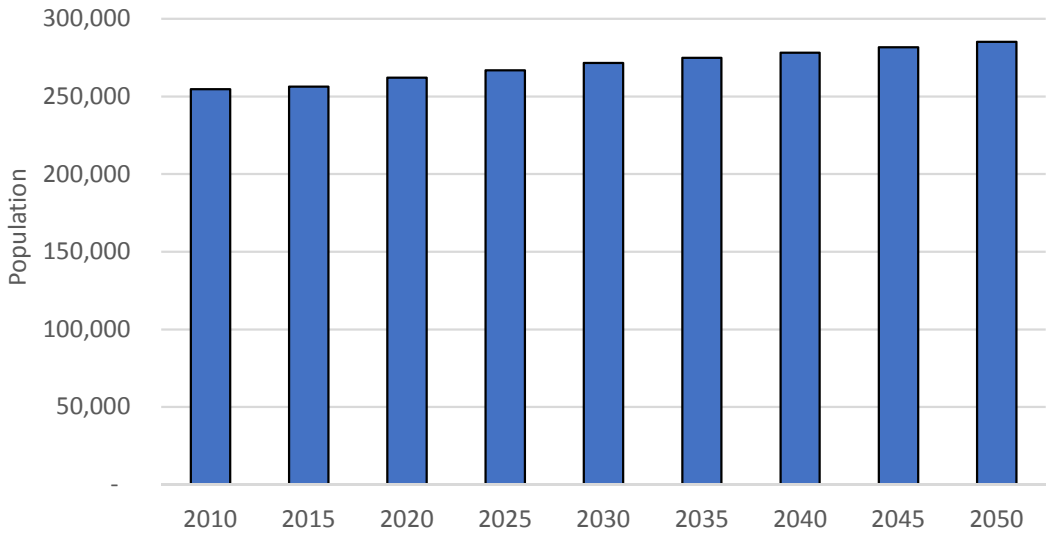
**Figure ES-4: Trends in Wastewater and Return Flows**




Data Source: Altamaha Water and Wastewater Forecasting Technical Memorandum; CDM Smith, 2017 and USGS data for energy withdrawals.

Energy totals shown represent total thermoelectric return flow; 35 MGD of the total 57 MGD (61%) is consumptive, the remainder (22 MGD) is discharged back to surface waters as return flow.

**Figure ES-5: Altamaha Region Population Projections (2010-2050)**




Source: Georgia Governor's Office of Planning and Budget, 2015

period, total wastewater flows in the region are expected to grow by 10% (10 MGD).

### *Comparison of Available Resource Capacity to Future Water Resource Needs*

#### Groundwater Availability

Groundwater from the Floridan aquifer is a vital resource for the Altamaha Region. Several groundwater modeling tools were developed as part of the water planning process to estimate the range of groundwater yield that can be pumped from select regional aquifers before specific impacts become evident, also referred to as sustainable yield. Overall, the results from the Groundwater Availability Resource Assessment (EPD, March 2010) indicate that the estimated range of sustainable yield for the modeled portions of the regional aquifer(s) is greater than the forecasted demands. Therefore, at this time no groundwater resource shortfalls are expected to occur in the Altamaha Region over the planning horizon. However, localized issues could arise in areas where there is a high well density and/or high volumes of groundwater withdrawal.

#### Surface Water Availability

Surface water is also an important resource used to meet current and forecasted future needs of the Altamaha Region. In order to analyze whether there is sufficient surface water to meet both off-stream uses of water and instream flow needs while meeting flow thresholds, a Surface Water Availability Resource Assessment model was developed and used in the state water planning process.

The results of the future conditions modeling from the Surface Water Availability Resource Assessment (EPD, May 2017) show that in some portions of the region, there are sufficient surface water supplies to meet current and forecasted water supply needs. However, in dry years, during some portions of the year, the modeled demand for off-stream uses of water results in projected impacts to instream flow thresholds (referred to as a potential "gap"). Table ES-1 summarizes the locations in or near the region where there is a forecasted gap between available surface water resources and

**Summary of Resource Assessment Results**

*Management Practices should be developed and implemented to address water resource shortfalls as determined by the three Resource Assessments.*

***Groundwater:*** *Overall, results indicate that the estimated range of sustainable yield for the modeled portions of the regional aquifer(s) is greater than the forecasted demands.*

***Surface Water Quantity:*** *There are sufficient surface water supplies at some locations throughout the Altamaha Region, but there are also projected surface water shortfalls at the Claxton, Eden, Kings Ferry, Atkinson, and Statenville nodes.*

***Surface Water Quality:*** *There are two river reaches within the Ogeechee River Basin, four river reaches within the Altamaha River Basin, two river reaches in the Ocmulgee River Basin, two river reaches in the Oconee, and two river reaches in the Suwannee that may exceed assimilative capacity.*

forecasted need. There are current and 2050 forecasted surface water gaps at the following locations in and near the region: Claxton (Canoochee River), Eden (Ogeechee River, outside of Altamaha Region), Kings Ferry (Ogeechee River, outside of Altamaha Region), Atkinson (Satilla River, outside of Altamaha Region) and Statenville (Alapaha River outside of the Altamaha Region). At each of these locations, the dominant surface water use type is agricultural. The projected increase of agricultural surface water use for the areas within the Altamaha Region that have current and/or future potential gaps is 1.1 MGD. Since there are current gaps at the referenced locations, it will be difficult to develop additional surface water to meet projected needs without increasing potential gaps. As described below, management practices are recommended by the Altamaha Council to address potential surface water gaps.

**Table ES-1: Summary of Modeled 2050 Potential Surface Water Gaps**

| Node | Duration of Gap (% of total days) | Average Flow Deficit | Long-term Average Flow |
|---|---|---|---|
| Atkinson | 5 | 20 cfs / 13 MGD | 2,236 cfs / 1,445 MGD |
| Claxton | 15 | 5 cfs / 3 MGD | 452 cfs / 292 MGD |
| Eden | 3.3 | 24 cfs / 16 MGD | 2,213 cfs / 1,430 MGD |
| Kings Ferry | 3 | 37 cfs / 24 MGD | 3,658 cfs / 2,364 MGD |
| Statenville | 12 | 32 cfs / 21 MGD | 1,058 cfs / 684 MGD |

Source: Synopsis Report, Surface Water Availability Assessment, May 2017, EPD
Note: Surface Water Availability modeling simulation period is from 1939 to 2013

## Assessment of Water Quality Conditions

One measure of the capacity of surface water to maintain its health and the health of the aquatic species living therein is the amount of residual dissolved oxygen in the water. As part of the Water Quality (Assimilative Capacity) Resource Assessment (EPD, May 2017), modeling of dissolved oxygen concentrations was performed by EPD for each surface water reach in the region that has upstream wastewater discharges to the reach. The modeling estimates the ability of the surface water to assimilate the amount of pollutants being discharged (also referred to as assimilative capacity). Each modeled river segment was classified as exceeding dissolved oxygen capacity, meeting dissolved oxygen capacity, or having available dissolved oxygen capacity. Table ES-2 summarizes the results of the assimilative capacity assessment for dissolved oxygen at permitted conditions. Assimilative capacity assessments indicate the potential need for improved wastewater treatment in some facilities within the Ogeechee, Altamaha, Ocmulgee, and Oconee River Basins.

| Table ES-2: Permitted Assimilative Capacity for DO in Altamaha Planning Council | | | | | | | |
|---|---|---|---|---|---|---|---|
| Basin | Available Assimilative Capacity (Total Mileage) | | | | | | Modeled Miles in Council |
| | Very Good (≥1.0 mg/L) | Good (0.5 to <1.0 mg/L) | Moderate (0.2 to <0.5 mg/L) | Limited (>0.0 to <0.2 mg/L) | None or Exceeded (<0.0 mg/L) | Unmodeled | |
| Altamaha | 152 | 57 | 44 | 86 | 46 | 0 | 385 |
| Ocmulgee | 120 | 81 | 54 | 22 | 29 | 0 | 306 |
| Oconee | 15 | 11 | 1 | 28 | 25 | 0 | 80 |
| Ogeechee | 19 | 69 | 65 | 15 | 10 | 4 | 182 |
| Suwannee | 0 | 1 | 0 | <1 | 9 | 0 | 11 |
| Source: GIS Files from the Updated Permitted Water Quality Resource Assessment; EPD, January 2017 | | | | | | | |

Under Section 303d of the federal Clean Water Act, a total maximum daily load must be developed for waters that do not meet their designated uses. A total maximum daily load represents the maximum pollutant loading that a water body can assimilate and continue meeting its designated use (i.e., not exceeding State water quality standards). A water body is deemed to be impaired if it does not meet the applicable criteria for a particular pollutant; consequently, total maximum daily loads are required to be established for these waters to reduce the concentrations of the exceeding parameters in order to comply with State water quality standards.

For the Altamaha Region, there are 74 impaired stream reaches (total impaired length of 755 miles) and 2 impaired lakes (total impaired area of 390 acres). Total maximum daily loads have been completed for 69 of the impaired stream reaches and for both of the impaired lakes. The majority of impairments are due to low dissolved oxygen and fecal coliform.

### *Identifying Water Management Practices to Address Water Resource Shortfalls and Future Needs*

The comparison of the Resource Assessments and the forecasted demands identified the region's likely resource shortfalls or gaps and demonstrated the necessity for region and resource-specific water management practices. In selecting the actions needed (i.e., water management practices), the Altamaha Council considered practices identified in existing plans, the Region's Vision and Goals, and coordinated with local governments and water providers as well as neighboring Councils that share these water resources.

The Altamaha Council has developed a management practice strategy based on the best data and modeling results available. The Council recognizes that as data are refined and modeling results improve—including water and wastewater projections and Resource Assessments—the resulting future needs and potential gaps may

change. Therefore, the Council has prioritized short-term management practices to address gaps with the understanding that more complex management practices may be required in the future. These short-term management practices are presented in Tables ES-3 and ES-4.

The Altamaha Council believes the Regional Water Plan should continue to be reviewed in defined increments in the future, such as every 5 years, to evaluate how the implemented management practices are performing toward addressing gaps and meeting forecasted needs and what additional measures might be required. If the selected management practices have not sufficiently addressed the gaps identified by the Resource Assessments, then additional management practices should be selected and implemented. The selected management practices will over time address identified gaps and meet future uses when combined with practices for all shared resource regions.

**Table ES-3: Short-Term Water Quantity Management Practices (0 – 10 Years)**

| |
|---|
| Utilize surface water and groundwater sources within the available resource capacities |
| Water conservation |
| Data collection and research to confirm the frequency, duration, severity, and drivers of surface water gaps (forecast methodology assumptions and Resource Assessment modeling) |
| Evaluate and ensure that future surface water permit conditions do not contribute to low flow concerns |
| Encourage sustainable groundwater use as a preferred supply in regions with surface water low flow concerns |
| Identify incentives and a process to sustainably replace a portion of existing surface water use with groundwater use to address low flow concerns |
| Evaluate the potential to use existing storage to address low flow concerns |
| Education to reduce surficial aquifer groundwater use impacts to low flow concerns |

**Table ES-4: Short-Term Water Quality Management Practices (0 – 10 Years)**

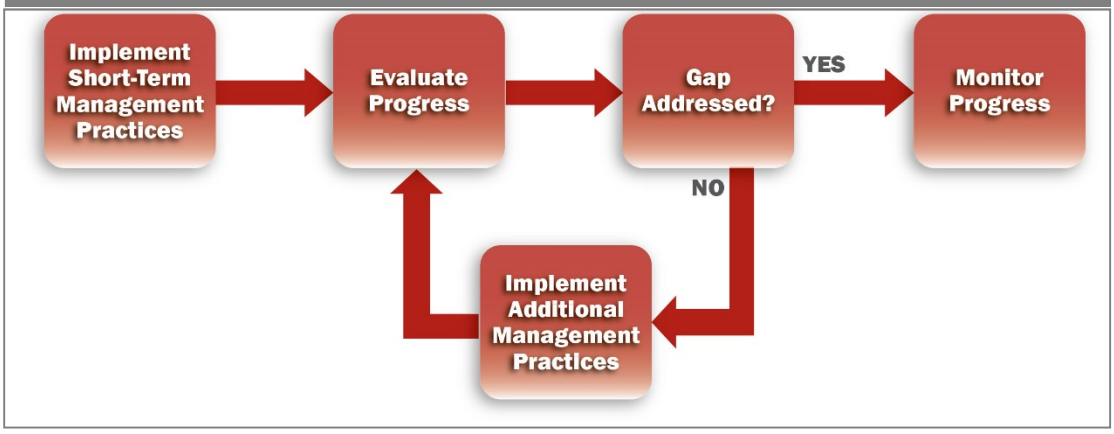
| |
|---|
| Point Sources:<br>– Support and fund current permitting and waste load allocation process to improve treatment of wastewater and increase treatment capacity<br>– Data collection and research to confirm discharge volumes and waste concentrations as well as receiving stream flows and chemistry |
| Non-point Sources:<br>– Data collection to confirm source of pollutants and causes; encourage stormwater ordinances, septic system maintenance, and coordinated planning<br>– Ensure funding and support for Best Management Practices programs by local and state programs, including urban/suburban, rural, forestry and agricultural Best Management Practices |
| Non-point Source Existing Impairments - Total maximum daily load list streams:<br>– Improve data on source of pollutant and length of impairment<br>– Identify opportunities to leverage funds and implement non-point source Best Management Practices |

### *Implementing Water Management Practices*

The Altamaha Council supports the concept of regional water resource planning with a focus on planning Councils composed of local governments, water users, water providers, industry, business and affected stakeholders. Local representatives are typically most familiar with local water resource issues and needs. The State has a

vital role providing technical support, guidance, and funding to support locally focused water resource planning. This plan should be viewed as a living, iterative document and the State should focus on the following principles: Education, Incentives, Collaboration, Cooperation, and Enabling. Supporting Implementation of the Altamaha Regional Water Plan will be primarily by various water users and wastewater utilities in the region. The most cost-effective and more readily implemented management practices will be prioritized for short-term implementation via an incremental and adaptive approach, as shown in Figure ES-6. If resource needs are not met and/or gaps are not addressed, then more complex management practices will be pursued. Future planning efforts should confirm current assumptions and make necessary revisions and/or improvements to the conclusions reached during this round of planning.

**Figure ES-6: Implementation of Management Practices**




### *Cost Considerations*

Planning level cost estimates were prepared for the various categories of management practices. A detailed summary of costs can be found in Section 7 of the Regional Water Plan. In most cases, costs are presented on a unit cost basis or when applicable as a total estimated cost for certain management practices. Total overall costs for the entire Plan were not specifically developed because the recommended practices are not intended to be mandated or prescriptive to the water and wastewater users and providers. In general, addressing surface water needs in the region from both a water supply and a water quality perspective are expected to present the largest challenges and have the most fiscal impact. For the Regional Water Plan to be most effective, wastewater utilities and agricultural water users will need the planning and implementation support to help them meet current and future needs. It is anticipated that several different funding sources and options will be used to secure funding for the various management practices outlined in the Regional Water Plan, and adequate funding will be a critical component of the successful implementation of the State Water Plan.

### *Implementation Considerations and Benchmarks – Helping Ensure Progress toward Meeting Future Needs*

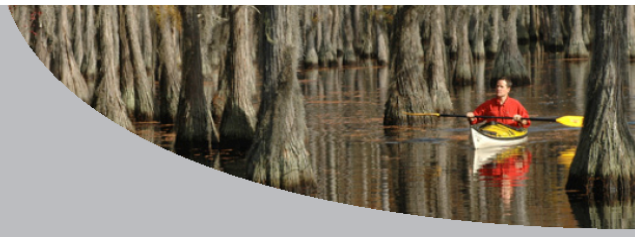
Effective implementation of the Regional Water Plan will require the availability of sufficient funding in the form of loans, and in some cases, possibly grants. In addition, many of the proposed management practices require ongoing coordination with affected stakeholders/water users and collaboration to help ensure successful solutions are identified and implemented. Finally, in many cases, monitoring progress toward addressing future needs will require improved data and information on the current actions and management practices that are already in place.

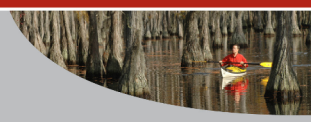
To assess progress toward meeting regional needs, the Altamaha Council identified several benchmarks, which can be used to evaluate the effectiveness of the Regional Water Plan. The benchmarks are discussed in Section 8 and include both the activities that should be accomplished and the measurement tools that can be used to assess progress.

The Altamaha Council suggests that EPD consider “institutionalizing” planning. This would entail a long-term commitment of staff and funding to: monitor and support Regional Water Plan recommendations; coordinate improved data collection, management and analysis; continue to develop and improve Resource Assessment tools; and help provide funding, permitting, and technical support to address gaps and water resource needs. Institutionalized planning would provide the framework to monitor management practice progress against the benchmarks presented, assist in determining the success of implemented programs, and evaluate what additional practices might be necessary.

The Altamaha Council supports the concept of regional water planning led by local representatives. The Council members wish to express their gratitude to former Governor Sonny Perdue, Lieutenant Governor Casey Cagle, and former Speaker of the House Glenn Richardson for their nomination to the Altamaha Council. The Regional Water Plan provides a recommended path forward to help achieve social, economic, and environmental prosperity for the region. The Council members are grateful for the opportunity to serve the region and State. The Altamaha Council members wish to remain involved in facilitating attainment of the Regional Water Plan benchmarks and making necessary revisions to the Plan.

# 1. INTRODUCTION





# Section 1. Introduction

***The Altamaha Council intends for this Regional Water Plan to be a working document, and work on this document is part of the continual planning process.***

**Summary**

*The Altamaha Regional Water Planning Council, established in February 2009 under the State Water Plan, has adopted a Vision and Goals for prioritizing water resource use and management within the region.*

*These guiding principles were used to identify and select water management practices that best address the needs and resource conditions of the Altamaha Region.*

Georgia is one of the fastest growing states in the nation. Couple that with recent unprecedented drought, increased competition for water supplies, and changing perspectives on how we use and value water. Based on these factors, we recognize the challenges of managing our valuable water resources. In response to these challenges, a State Water Council was formed to develop a state-wide water planning process.

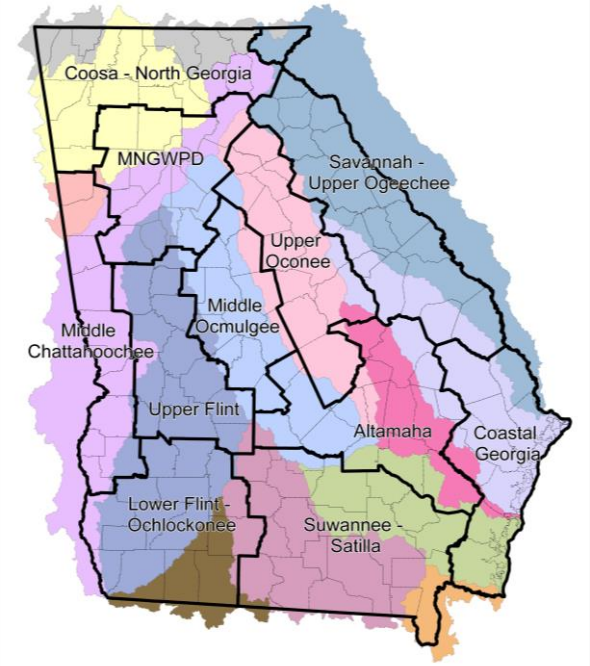
The water planning processes began in 2008, when the State Water Council submitted the *Georgia Comprehensive State-wide Water Plan* (State Water Plan) to the Georgia General Assembly and the state-wide water planning process was approved. The purpose of the State Water Plan is to guide Georgia in managing water resources in a sustainable manner to support the State's economy, protect public health and natural systems, and enhance the quality of life for all our citizens. The State Water Plan identifies state-wide policies, provides planning guidance, and establishes a planning process for completion of Regional Water Development and Conservation Plans (Regional Water Plans). The Altamaha Regional Water Planning Council (Altamaha Council) was formed to help guide the completion of the 2011 Regional Water Plan and they have now produced this update. The Altamaha Council is composed of membership based on a nomination and appointment process by the Governor, Lieutenant Governor, and Speaker of the House.

The Altamaha Regional Water Plan was first completed and adopted in 2011. During the 2016–2017 plan update process, this document was updated from the original 2011 Regional Water Plan for the Altamaha Region based on updated regional water demand forecasts, updated resource assessment modeling, and the evaluation of future gaps in water availability and water quality. This updated plan also includes the revised management practices recommended by the Altamaha Council to either address future water resource management needs or to refine or clarify management practices. A table is provided in Appendix A that identifies the portions of the plan that have been updated and provides a short explanation for why the update was made (for instance, a change in circumstance in the region, or an update to the technical work such as updated projections or forecast).

## 1.1. The Significance of Water Resources in Georgia

Of all Georgia's natural resources, none is more important to the future of our State than water. Georgia has abundant water resources, with 14 major river systems and multiple groundwater aquifer systems. These waters are shared natural resources. Streams and rivers run through many political jurisdictions. The rain that falls in one region of Georgia may replenish the aquifers used by communities many miles away. And, while water in Georgia is abundant, it is not an unlimited resource. It must be carefully managed to meet long-term water needs.

**Figure 1-1: Regional Water Planning Councils**

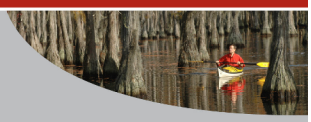



Since water resources, their conditions, and their uses vary greatly across the State, selection and implementation of management practices on a regional and local level is the most effective way to ensure that current and future needs for water supply and assimilative capacity are met. Therefore, the State Water Plan calls for the preparation of 10 Regional Water Plans. The eleventh regional water planning district, the Metropolitan North Georgia Water Planning District (MNGWPD, also known as "the District"), was created by State law in 2001 and had existing plans in place. Figure 1-1 illustrates the 11 council boundaries and major surface watersheds, which are shown by the different background colors.

This Regional Water Plan prepared and updated by the Altamaha Council describes the current and projected water resource needs of the region and summarizes regionally appropriate management strategies (also referred to as water management practices) to be employed in Georgia's Altamaha Water Planning Region over the next 35 years to help meet these needs.

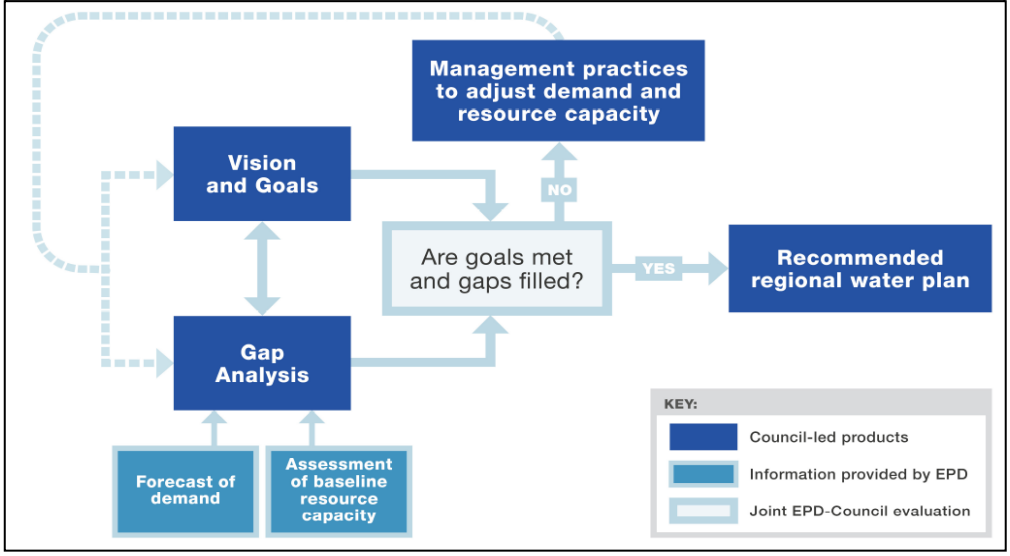
## 1.2. State and Regional Water Planning Process

The State Water Plan calls for the preparation of Regional Water Plans designed to manage water resources in a sustainable manner through 2050. The original (2011) Regional Water Plan was prepared following a consensus-based planning process illustrated in Figure 1-2. As detailed in the Altamaha Council's Memorandum of Agreement (MOA) with the Georgia Environmental Protection Division (EPD) and Department of Community Affairs (DCA) as well as the Council's Public Involvement



Plan (PIP), the process required and benefited from input of other regional water planning councils, local governments, and the public. For this plan update, a similar approach was followed, including a review of the original vision and goals, updates to the water and wastewater demands, updates to the resource assessments, and a re-evaluation of future gaps. Public/local government input and coordination with other regional water planning councils also informed the plan update.

**Figure 1-2: State Water Planning Process**

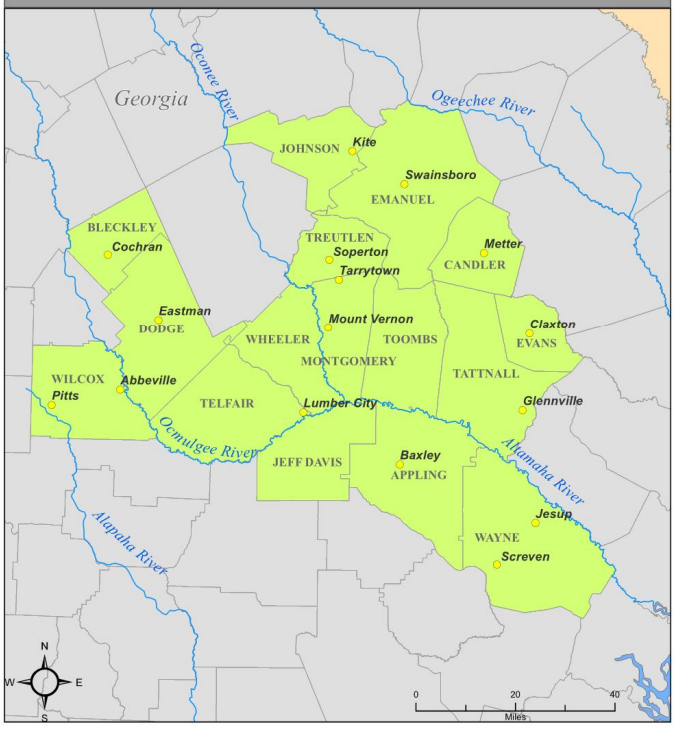



## 1.3. The Altamaha Water Planning Region Vision and Goals

Following the process established in the State Water Plan, the Altamaha Council was established in February 2009. The Altamaha Council has 23 members, which includes 3 alternates and 2 Ex-Officio Members. Figure 1-3 provides an overview of the Altamaha Region and the residential locations of the Altamaha Council members.

To develop the 2011 Regional Water Plan, the Altamaha Council met collectively for the first time on March 13, 2009 at a kickoff meeting for the 10 regional water planning councils. The meeting

**Figure 1-3: Location of Altamaha Council Members**



focused on: providing an orientation to the water planning process; a preliminary overview of Georgia's water resources; and establishing an understanding of the schedule for completing the Regional Water Plan, the Council's meeting schedule, and requirements. As part of this update, the Altamaha Council met over a series of meetings in 2016 and 2017 to revise and update each of the sections of the plan, as appropriate.

### Developing the Region's Council Procedures

Initially, the planning process focused on establishing the Altamaha Council leadership along with operating procedures and rules for conducting meetings. The operating procedures and rules were appended to the Memorandum of Agreement that was executed between EPD, DCA, and the Altamaha Council. The Memorandum of Agreement was unanimously approved by the Altamaha Council and executed on June 18, 2009. A copy of this document can be accessed on the Council's website.

In support of the Memorandum of Agreement, the Altamaha Council formed six subcommittees to provide planning guidance during various development stages of the development of the 2011 Regional Water Plan. The subcommittees consisted of the following: Vision and Goals, Public Involvement Plan, Water and Wastewater Forecasting, Plan Drafting (Table of Contents), Plan Drafting (Report), and Management Practices.

### Developing Regional Vision and Goals

A major element of Georgia's state and regional water planning process is the identification of a Vision and Goals that describe the economic, population, environmental, and water use conditions that are desired for the region. The Vision and Goals describe the Altamaha Council's priorities for water resource use and management. This information is used to help guide the identification and selection of water management practices for the Altamaha Region and to communicate these priorities and values to other regions of the State.

### Vision Statement (as established September 17, 2009 and revised on October 28, 2010)

*"The vision of the Altamaha Regional Water Planning Council is to wisely manage, develop, and protect the region's water resources for current and future generations by ensuring that the Altamaha basin's water resources are sustainably managed to enhance quality of life and public health, protect natural systems including fishing, wildlife and wildlife utilization activities, and support the basin's economy."*

### Goals (as established November 19, 2009)

The Altamaha Council has identified 12 goals for the region. It is important to note that the goals summarized below are not presented in order of priority, but rather were assigned a number to identify specific goals addressed as part of the water management practice selection process (Section 6).

The Altamaha Council recognizes that we are generally not the primary implementation entity associated with water resource development, use, and management. Nevertheless, the Council wishes to express meaningful, action oriented goals for the future use and management of water resources in our region. The following goals are identified with this principle in mind.

### Water Systems/Supply Sustainability

1. Help ensure protection and management of surface and groundwater recharge areas to ensure sufficient long-term water supplies for the region.
2. Identify opportunities to maximize and optimize existing and future supplies.
3. Promote water conservation and water use efficiency for all water use sectors to allow for sufficient long-term water supplies.
4. Identify opportunities to better prepare for and respond to climate and water supply variability and extremes.
5. Identify and implement cost-effective water management strategies.

### Economic Sustainability and Development

1. Manage and develop water resources to sustainably and reliably meet domestic, commercial, agricultural, and industrial water needs.
2. Manage groundwater and surface water to encourage sustainable economic and population growth in the region.
3. Identify opportunities to minimize excessive regulations and the resulting negative economic impacts (especially in rural areas); while maintaining quality and quantity of water supply.

### Quality of Life and Public Health Enhancement

1. Ensure an adequate water supply of suitable quality to meet current and future human, environmental and recreational needs of the region and citizens of Georgia.
2. Optimize existing water and wastewater infrastructure, including identifying opportunities to implement regional water and wastewater facilities.
3. Identify opportunities to manage water, wastewater, and stormwater to improve water quantity and quality, while providing for wise land management, wetland protection, and wildlife sustainability.
4. Work collaboratively with other regions that share resources to help ensure that activities outside the Altamaha Region do not adversely impact the region.

More information regarding the region's Vision and Goals can be found at the Council's website.

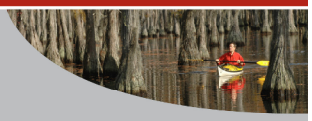
### The Altamaha Council's Public Involvement Plan

A foundational principle of the Georgia water planning process is public and stakeholder participation and coordination among multiple interests. The Altamaha

Council developed a Public Involvement Plan to help guide and implement an inclusive planning process. The Public Involvement Plan was adopted by the Altamaha Council on November 19, 2009 and can be accessed at the Council's website.

Outreach to the public, local governments, water providers, and users was accomplished by e-mail correspondence, direct communication, and updates provided by Council members at local government and other interest group meetings. Opportunity for public and local government comment was provided at each Council meeting. More information regarding public outreach can be found in the Altamaha Council Public Outreach Technical Memorandum available at the Council's website.

# 2. THE ALTAMAHA WATER PLANNING REGION



# Section 2. The Altamaha Water Planning Region

## 2.1. History and Geography

The Altamaha Region is located within the Coastal Plain Physiographic Province. The topography of the region is characterized by gentle slopes that reflect the geologic history of Tertiary and Quaternary marine incursions and regressions. Approximately 90% of the Coastal Plain sediments exposed in the area are sands and clays. The major land cover in the region is forested lands and agriculture, which are important drivers for the region's economy.

**Summary**

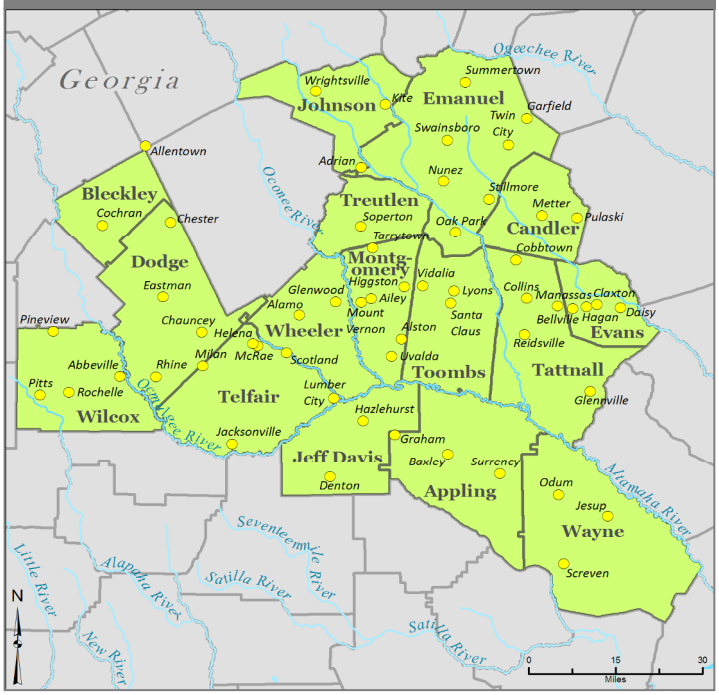
*The Altamaha Region encompasses 16 counties in the south central portion of Georgia. Predominant land cover in the region includes agriculture, forest, and wetland areas.*

*The Altamaha River, formed by the confluence of the Ocmulgee and Oconee Rivers, is the major surface water resource in the region.*

*The Floridan aquifer, one of the most productive aquifers in the United States, is the primary source of groundwater in the region.*

*The regional domestic, commercial, industrial, agricultural, thermoelectric power, and recreational water uses are vital to the region's economy and quality of life.*

**Figure 2-1: Surface Water Resources, Counties, and Major Cities**




### Surface Water Resources

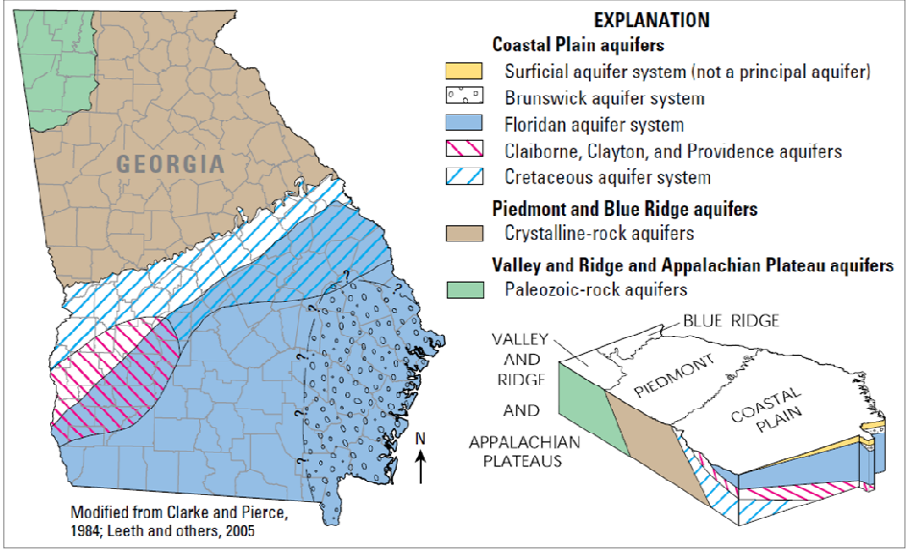
Figure 2-1 provides an overview of the surface water resources in the Altamaha Region. The Altamaha River is the major surface water feature in the region. The Altamaha River, formed by the confluence of the Ocmulgee and Oconee Rivers, is 127 miles long and has a drainage area of approximately 14,000 square miles (EPD, 2003). The river originates in the Northern Piedmont province of north Georgia, traverses southeast through the Coastal Plain region, and discharges to the Atlantic Ocean near Darien, Georgia. It is the only major river in Georgia that is contained wholly within the boundaries of the State. The Altamaha River is a popular fishing resource to the region and is home to 74 species of fish including sunfish, largemouth bass, bluegill, black crappie, and catfish.

## Groundwater Resources

Groundwater is a very important resource for the Altamaha Region. Figure 2-2 depicts the major aquifers of Georgia. Based on 2015 forecasted groundwater withdrawal data, approximately 96% of groundwater supplied in the region is from the Floridan aquifer, which is one of the most productive groundwater aquifers in the United States. The remaining groundwater is supplied by the surficial, Claiborne, Gordon, Cretaceous, Dublin and Brunswick aquifers.

The Floridan aquifer is primarily comprised of limestone, dolostone, and calcareous sand. The aquifer is generally confined, but at its northern extent there are unconfined and semi-confined zones. The Floridan aquifer increases in thickness eastward across the State and is approximately 400 feet thick in Glynn County. The aquifer is very productive, with typical well yields of 1,000-5,000 gallons per minute.

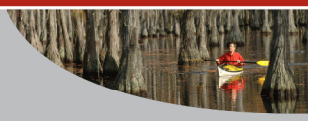
**Figure 2-2: Major Georgia Aquifers**




The northern portion of the Altamaha Region is within the Cretaceous aquifer area, which consists of sands and gravels. The eastern portion of the Altamaha Region is within the Brunswick aquifer area, which consists of sands and limestones. Where these aquifers exist, they are used in addition to the Floridan aquifer for water supply. A surficial aquifer is present beneath most of the Coastal Plain area; however, it is usually not very thick and is not typically used as a primary source of water supply.

## Climate

A review of available data for the region from the Southeast Regional Climate Center indicates that the climate is temperate with mild winter and hot summers. Average maximum temperatures are around 92°F in July and average minimum temperatures are around 35°F in January. The area receives abundant rainfall, approximately 42-48 inches per year, with the greatest rainfall occurring during July and August and the least in October and November. Snowfall is rare and the historical average for the region is 0.1 inches near the coast to 0.3 inches further inland.



## 2.2. Characteristics of Region

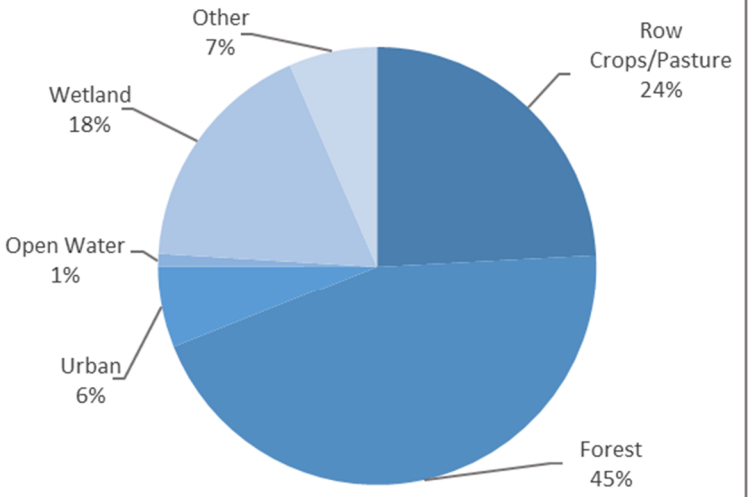
The Altamaha Council encompasses 16 counties in the south central portion of Georgia, with a projected 2015 population of approximately 256,305 (Governor's Office of Planning and Budget, 2015). The major population centers in the region include Vidalia, Jesup, Swainsboro, Eastman, and Glennville.

Based on information obtained from Georgia Department of Labor Local Area Profiles, major employers in the region include Rayonier Performance Fibers, LLC in Wayne County and Edwin I. Hatch nuclear power plant in Appling County. The primary economic sectors in the region include agriculture, forestry, fishing and hunting, professional and business services, education, healthcare, manufacturing, public administration, and construction.

The region includes two colleges within the Technical College System of Georgia: Coastal Pines Technical College in Jesup and Southeastern Technical College (Vidalia and Swainsboro campuses). The region also includes East Georgia State College in Swainsboro, which is part of the University System of Georgia, as well as Middle Georgia State University in Eastman and Brewton-Parker College in Mount Vernon. In addition to county jails, there are 15 state and federal correctional facilities, which are important employers and water users in the Altamaha Region.

A summary of 2008 land cover distribution is shown in Figure 2-3, based on data obtained from the University of Georgia Natural Resources Spatial Analysis. Forests cover 45% of the Altamaha Region, and agriculture and wetlands cover 24% and 18% of the region, respectively. The term wetland refers to land cover and does not infer a regulatory determination. Urban development accounts for only 6% of the land cover within the Altamaha Region. The remaining land cover (7%) consists of water and open spaces. Based on the inventory of Georgia's irrigated cropland developed as part of the agricultural demand assessment in 2016, peanut, corn and cotton account for the majority of crops irrigated in the Altamaha Region. These crops cover nearly 69% of the irrigated acreage within the region. Fresh vegetables and

**Figure 2-3: Land Cover Distribution**




Adapted from:
University of Georgia
Natural Resources Spatial Analysis Laboratory
Percentages are based upon land use estimates from 2008

Note: "Other" represents clearcut/sparse, beaches/dunes, and quarries/outcrops land use categories

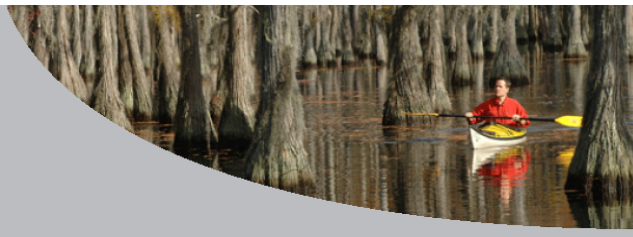
soybeans are also planted widely within the region.

## 2.3. Local Policy Context

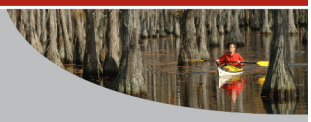
### Regional Commissions

Regional Commissions are agencies of local governments and representatives from the private sector that facilitate coordinated and comprehensive planning at the local and regional levels. Regional Commissions often assist their membership with conformity to minimum standards and procedures and serve as liaisons with state and federal agencies. There are 12 Regional Commissions in Georgia. Except for Laurens County, the Heart of Georgia Altamaha Regional Commission covers the same counties as the Altamaha Council.

In July 2009, the Georgia Department of Community Affairs required the Regional Commissions to adopt, maintain, and implement a Regional Plan (DCA Rule 110-12-6). The Altamaha Regional Commission's Regional Plan provides guidance to regional and local business leaders, local governments, state and federal agencies, and citizens to promote quality growth in region. It is a vision of the future for the region and includes quality community-based objectives related to water resources such as water supply, wastewater, and stormwater management. A key component is the establishment of "performance standards," which are actions, activities, or programs a local government can implement or participate in that will advance their efforts to meet the vision of the Regional Plan. The Altamaha Regional Commission's Regional Plan defines two achievement thresholds (Minimum and Excellence), which are attained by implementing the performance standards. Local governments are required to achieve the Minimum Standard to maintain their Qualified Local Government status, which qualifies them for certain state funding. By achieving the Excellence Standard, a local government may be eligible for special incentives. The Heart of Georgia Altamaha Regional Commission completed their Regional Plan in 2013.



# 3. WATER RESOURCES OF THE ALTAMAHA WATER REGION



# Section 3. Water Resources of the Altamaha Region

## 3.1. Current Major Water Use in Region

Based on data summarized from the 2016 USGS report "Water Use in Georgia by County for 2010; and Water-Use Trends, 1985-2010", water supply in the Altamaha Region for 2010 totaled approximately 203 million gallons per day (MGD) and was comprised of 61% groundwater and 39% surface water, as shown in Figure 3-1. Approximately 79 MGD were withdrawn from surface waters in the region to supply the energy and agricultural sectors, as shown in Figure 3-2. Figure 3-3 shows that about 124 MGD of groundwater withdrawn were predominantly used to supply industrial (49%) and agricultural uses (30%) while municipal, self-supply, and energy made up the remaining uses. Wastewater treatment types in the region are shown in Figure 3-4. Approximately 108 MGD of surface water were returned; 52% from industries and 48% from municipal sources.

## 3.2 Current Conditions Resource Assessments

EPD developed three Resource Assessments to evaluate surface water quality, surface water availability, and groundwater availability throughout the State. These assessments analyzed the capacity of water resources to meet demands for water supply and wastewater discharge without causing unacceptable local or regional impacts according to metrics established by EPD. These assessments were completed on a resource basis (river basins and aquifers). The results of the updated Resource Assessments (EPD) under current conditions are summarized herein as they relate to the Altamaha Region. As described in more detail below, the term "gap" is used to indicate when the current or future use of water has been identified as potentially causing unacceptable impacts.

**Summary**

*In 2010, surface water and groundwater withdrawal in the Altamaha Region totaled approximately 203 MGD to accommodate municipal, industrial, agricultural, and energy demands. Groundwater supplies are currently sufficient on a regional basis to meet uses across the region.*

*The availability of surface water to meet current uses varies significantly across the region, but in the majority of the region there are sufficient surface water supplies to meet current uses. On the smaller rivers (i.e., Alapaha, Canoochee, Ogeechee, and Satilla Rivers) with higher water use, river flows are at times (during drier years) insufficient to meet both off-stream uses and instream needs.*

*Under current conditions, there are several locations in the region where dissolved oxygen levels may be insufficient to assimilate wastewater discharges. The majority of wastewater in the region is disposed of as a point source discharge from municipal, industrial, and energy uses.*

*Water quality in several river reaches and water bodies does not meet the designated use for the resource. The majority of these occurrences are associated with low dissolved oxygen and fecal coliform.*

Figure 3-1: 2010 Water Supply by Source Type

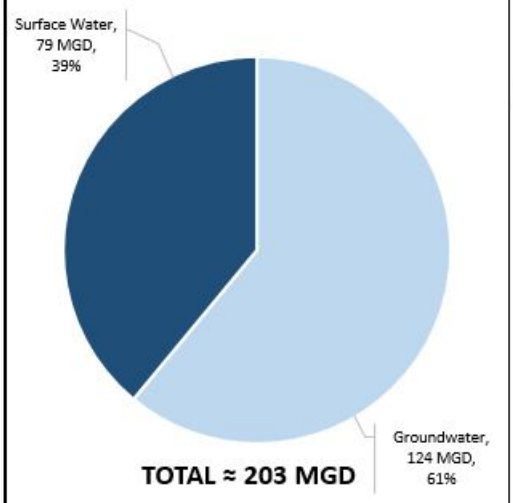



Figure 3-2: 2010 Surface Water Withdrawal by Category

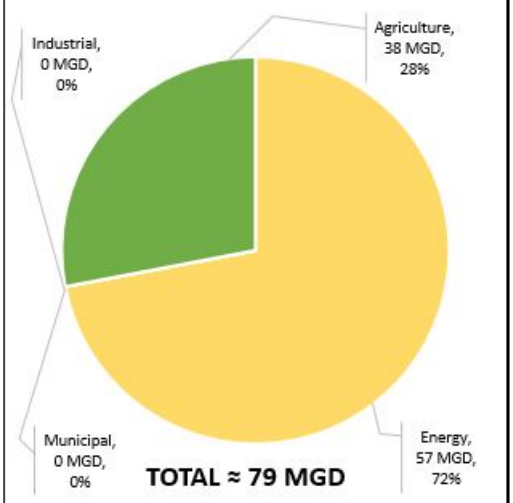



Figure 3-3: 2010 Groundwater Use Withdrawal Category

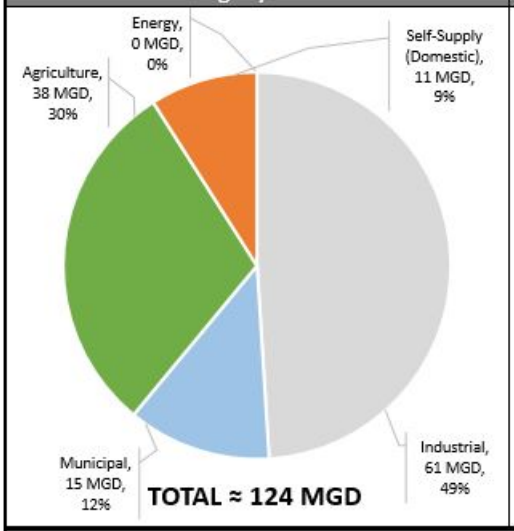
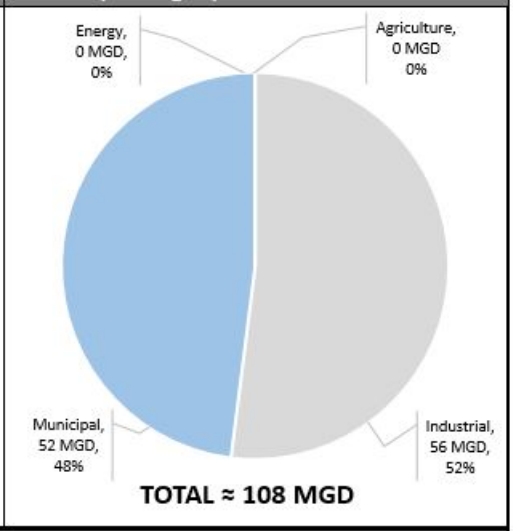



Figure 3-4: 2010 Surface Water Return Flow by Category



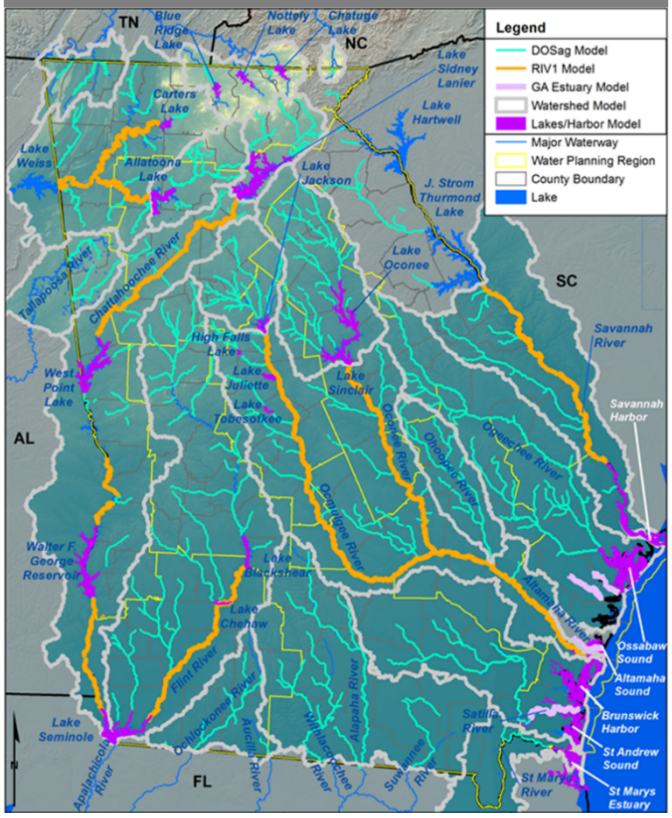

Data Source: "Water Use in Georgia by County for 2010; and Water-Use Trends, 1985-2010 (USGS, 2016)

### 3.2.1. Current Surface Water Quality (Assimilative Capacity)

The Water Quality (Assimilative Capacity) Resource Assessment (EPD, 2017) estimates the capacity of Georgia's surface waters to absorb pollutants without unacceptable degradation of water quality. The term assimilative capacity refers to the ability of a water body to naturally absorb pollutants via chemical and biological processes without harming aquatic life or humans who come in contact with the water. A water body can be overloaded and violations of water quality standards may

result. Water quality standards define the uses of a water body and set pollutant limits to protect those uses. The Water Quality (Assimilative Capacity) Resource Assessment evaluated the capacity of surface waters to process pollutants without violating water quality standards. The current (also referred to as a baseline) assimilative capacity results focus on dissolved oxygen (DO), and nutrients in some areas of the State (specifically nitrogen and phosphorus), and chlorophyll-a (a parameter that is closely tied to lake water quality). The assessments evaluate the impact of current wastewater and stormwater discharges with current withdrawals, land use, and meteorological conditions.

**Figure 3-5: Assimilative Capacity Models**




### *Assimilative Capacity Modeling (Dissolved Oxygen)*

One measure of the capacity of a stream to maintain its health and the health of the aquatic species living therein is the amount of residual DO in the waters of the stream. As shown in Figure 3-5, DO modeling was performed by EPD for each reach that has upstream wastewater dischargers (light blue segments and orange segments). The current conditions assimilative capacity analysis incorporated municipal and industrial wastewater facilities operating at their full permitted discharge levels (flow and effluent discharge limits as of 2014).[1] Based on the results, each segment was classified as exceeding DO capacity, meeting DO capacity, or having available DO capacity. The results of the current permitted conditions DO modeling are presented in Table 3-1 and Figure 3-6 for the Altamaha Region, which includes portions of the Altamaha, Oconee, Ocmulgee, Ogeechee, and Suwannee river basins.

Segments with exceeded assimilative capacity may result from a number of factors including: point and/or non-point sources of pollutants; modeling assumptions regarding wastewater discharge, stream flow and temperature; and naturally low DO conditions in the receiving stream. When model results show DO assimilative capacity as exceeded, a potential "gap" exists between the amount of pollutants

[1] Since 2014, updated effluent discharge limits were issued to one of the major wastewater discharge facilities in the region (Rayonier Advanced Materials, Wayne County). The updated effluent discharge limits are incorporated into the future conditions DO assimilative capacity analysis (see Section 5.3 and Figure 5-4).

discharged and the ability of the receiving stream to assimilate the pollutants. These points were considered when developing recommended strategies to address water quality needs in the region.

**Table 3-1: Current (Permitted) Conditions DO Assimilative Capacity in Altamaha Region**

| Basin | Available Assimilative Capacity (Total Mileage) | | | | | | Total River Miles in the Council Area |
|---|---|---|---|---|---|---|---|
| | Very Good (≥1.0 mg/L) | Good (0.5 to <1.0 mg/L) | Moderate (0.2 to <0.5 mg/L) | Limited (>0.0 to <0.2 mg/L) | None or Exceeded (<0.0 mg/L) | Unmodeled | |
| Altamaha | 152 | 57 | 44 | 86 | 46 | 0 | 385 |
| Ocmulgee | 120 | 81 | 54 | 22 | 29 | 0 | 306 |
| Oconee | 15 | 11 | 1 | 28 | 25 | 0 | 80 |
| Ogeechee | 19 | 69 | 65 | 15 | 10 | 4 | 182 |
| Suwannee | 0 | 1 | 0 | <1 | 9 | 0 | 11 |

Source: GIS Files from the Updated Permitted Water Quality Resource Assessment; EPD, January 2017

The current permitted conditions DO modeling incorporated municipal and industrial wastewater dischargers operating at their full permitted flow and effluent limits. EPD also provided the Council with the results of current conditions DO modeling analysis in the Altamaha basin that incorporated actual wastewater discharge levels (flow and effluent) from 2014. The results of that analysis are shown in Figure 3-7.

### *Nutrient Modeling*

In addition to Assimilative Capacity modeling for DO, EPD completed nutrient (total nitrogen and total phosphorus) modeling. The location of the watershed model boundaries, and lakes, harbors and estuaries model locations are shown in Figure 3-5. There are currently no nutrient standards for total nitrogen and total phosphorus, but these standards may be developed within this region following a public stakeholder process. The Altamaha Council proactively identified several non-point source best management practices (BMPs) that can be used to help reduce nutrient loading as discussed in Section 6.

## Figure 3-6: Results of Assimilative Capacity Assessment – DO at Current (Permitted) Conditions

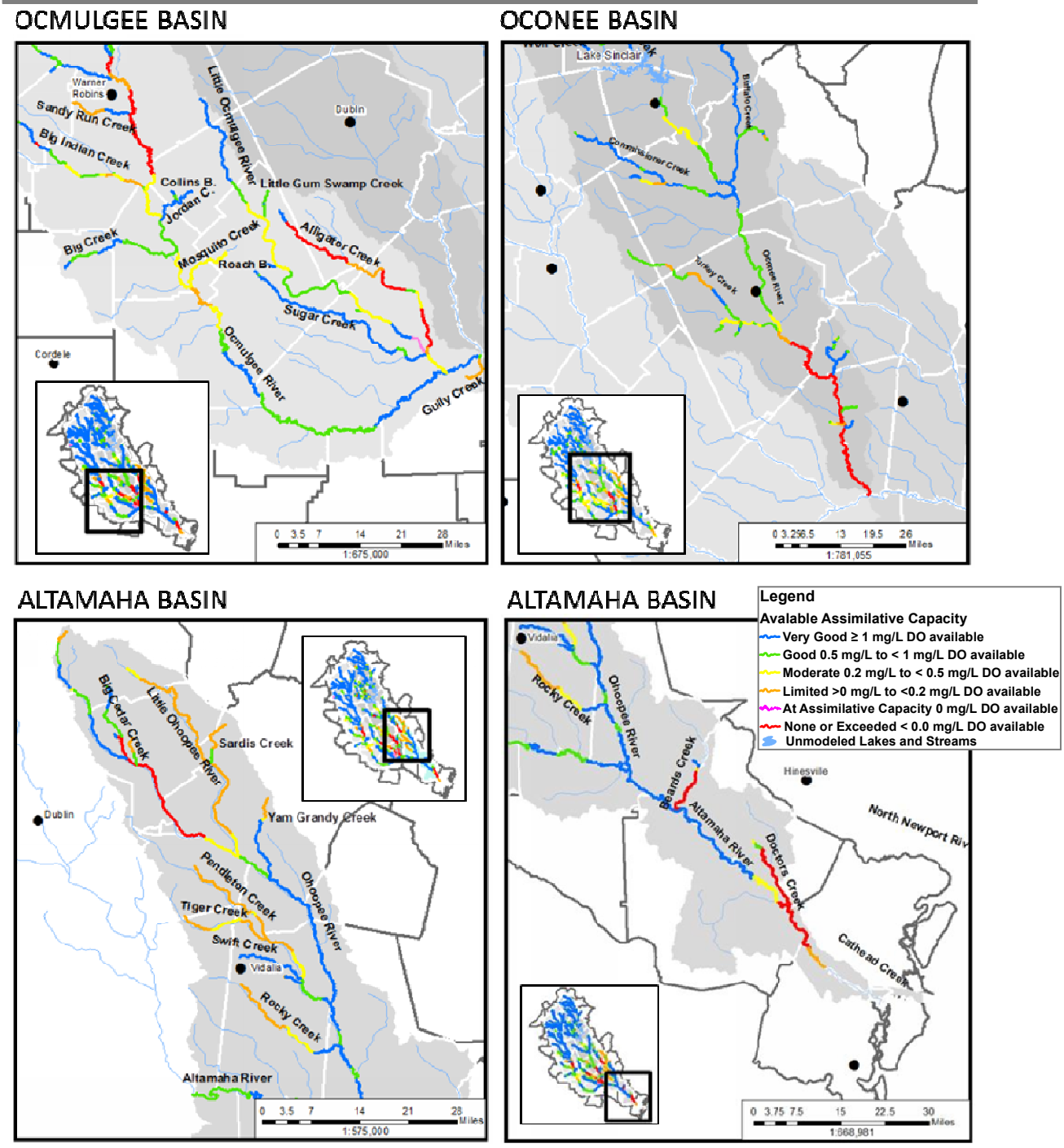
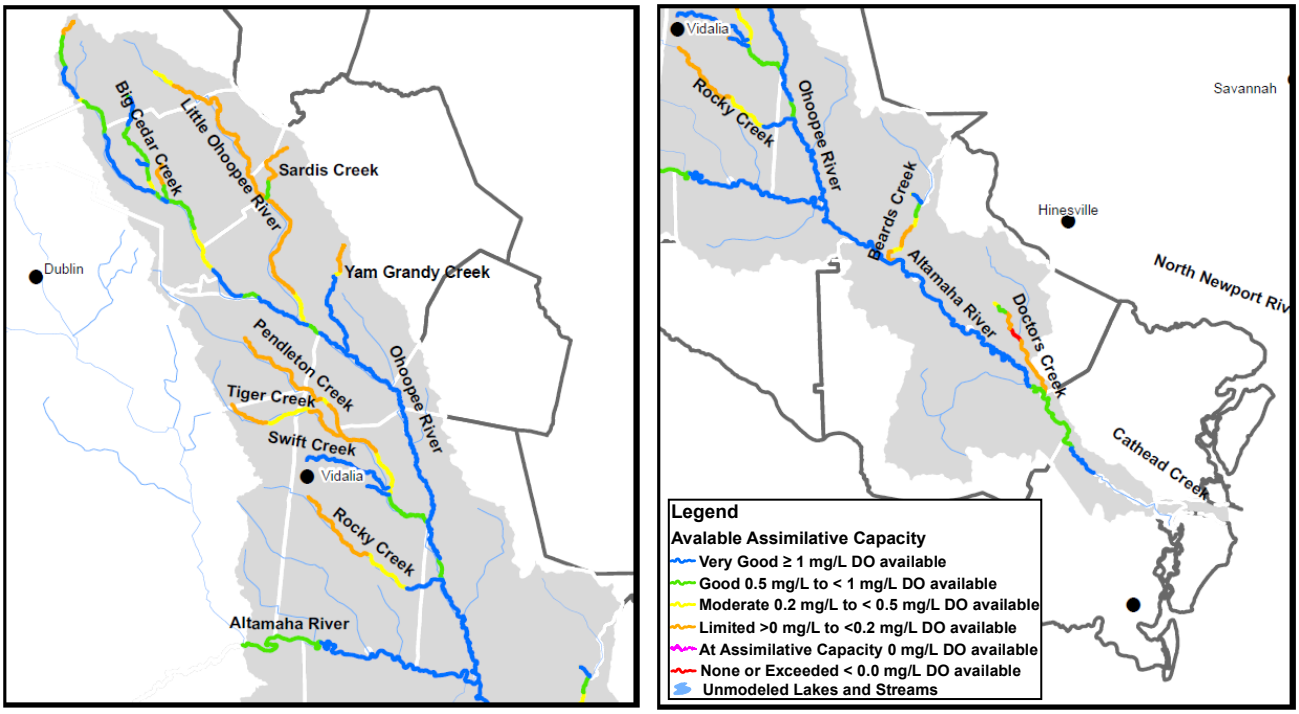


**Figure 3-7: Results of Assimilative Capacity Assessment – DO at Current (2014 Discharge) Conditions in the Altamaha Basin**




### 3.2.2. Current Ecosystem Conditions and Instream Uses

The Altamaha Region encompasses parts of the Southern Coastal Plain and the Southeastern Plains ecoregions. The rivers in these ecoregions support a diversity of fish and wildlife and provide numerous recreational opportunities. There are two Public Fishing Areas (Dodge County and Evans County) and six Wildlife Management Areas managed by the Georgia Department of Natural Resources (DNR) in the Altamaha Region. These areas provide public access to rivers for fishing, hunting, and other recreational activities. Bowens Mill Fish Hatchery, also operated by DNR, produces a variety of fish that are stocked in both public and private waters around the State.

With over 1.29 million resident anglers, fishing is the most popular wildlife-related activity in Georgia (DNR-WRD, 2006). Annually, the Altamaha River is the destination for a significant number of recreational angling trips and provides a corresponding positive economic impact. The most sought-after species are largemouth bass, redbreast sunfish, bluegill, redear sunfish, channel catfish, flathead catfish, and mullet. DNR is currently involved in a restoration effort aimed at striped bass, another popular sport fish. Striped bass numbers in the Altamaha River are thought to be low partially due to the limited number of coolwater springs available in the river during summer.

The Altamaha River and its tributaries provide important riverine habitat for diadromous fish (fish that travel between rivers and the ocean to breed), including American eel, American shad, hickory shad, blueback herring, Atlantic sturgeon, and shortnose sturgeon. The Altamaha River also supports commercial fishing for American shad, eels, blue crab, and shrimp.

The 2005 Comprehensive Wildlife Conservation Strategy identified 71 high priority animals that inhabit the Southern Coastal Plain ecoregion and 85 high priority animals in the Southeastern Plains ecoregion (more information is available at (www.georgiawildlife.com/node/1370). Several of these species depend on rivers for part or all of their lifecycle including amphibians, fish, mammals, mollusks, and reptiles. Federally endangered species in the Altamaha Region that inhabit rivers and lakes include the shortnose sturgeon (Acipenser brevirostrum). There were 25 identified high priority habitats in the Southern Coastal Plain ecoregion and 27 high priority habitats in the Southeastern Plains (CWCS, 2005) (for more information on high priority waters and protected species go to www.georgiawildlife.com/node/1377 and www.georgiawildlife.com/node/1366). The Nongame Conservation Section (Department of Natural Resources, Wildlife Resources Division) can be contacted for additional information on rare aquatic species. Riverine systems and processes are important to many of these habitats, such as alluvial rivers and swamps, bottomland hardwood forests, blackwater streams, canebreaks, and open-water ponds and lakes. These high priority streams and watersheds are considered important for conservation of at least one high-priority habitat or species located in the Altamaha Region.

Several rivers and watersheds in this region have been identified as ecologically important, including the Altamaha, Ocmulgee, and Ogeechee rivers. In the Southern Coastal Plain ecoregion, conservation lands make up 14% of the land area (CWCS, 2005). The percentage of lands in conservation is lower in the Southeastern Plains ecoregion at 2.6% (CWCS, 2005).

The major rivers that flow through and from the Altamaha Region also pass through the Coastal Regional Council boundary and discharge to the Atlantic Ocean. The coastal area contains a unique combination of fresh, brackish and salt water environments. The area is defined by barrier islands, sand beaches, open Atlantic Ocean, and there are 9 major estuaries including 350,000 acres of salt marsh and 150,000 acres of open water. Shipping channels are maintained in three estuaries – the lower Savannah River, St. Simons, and Cumberland. Otherwise, the remainder are very similar in depth, size and other physical characteristics as they were at the time of European settlements of Georgia.

An estuary is a semi-enclosed body of water, which has a free connection with the sea and within which sea water is measurably diluted with fresh water. Without the fresh water input, such areas in Georgia would be salt water lagoons or bays. A key characteristic of an estuary is salinity, which can be highly variable depending on the location within the estuary and the estuary itself. Sources of freshwater for estuaries include: fresh water river discharges, industrial and municipal discharges of

groundwater after use and treatment, and upwelling of groundwater through geologic features. Estuarine environments support a diversity of life, both aquatic and terrestrial, unparalleled in other portions of the State. Hundreds of species of animals and plants exist because of the unique mixing of salt water and fresh water. If the fresh water was removed, the diversity would change immensely from what is found today. Maintaining fresh water inputs to Georgia's estuaries is vital for maintaining a unique coastal environment, which provides a myriad of social and economic benefits, as well as invaluable ecological services to the citizens of Georgia. (Personal Communication: Spud Woodward, Coastal Resources Division, Georgia Department of Natural Resources).

### *Impaired Water Bodies*

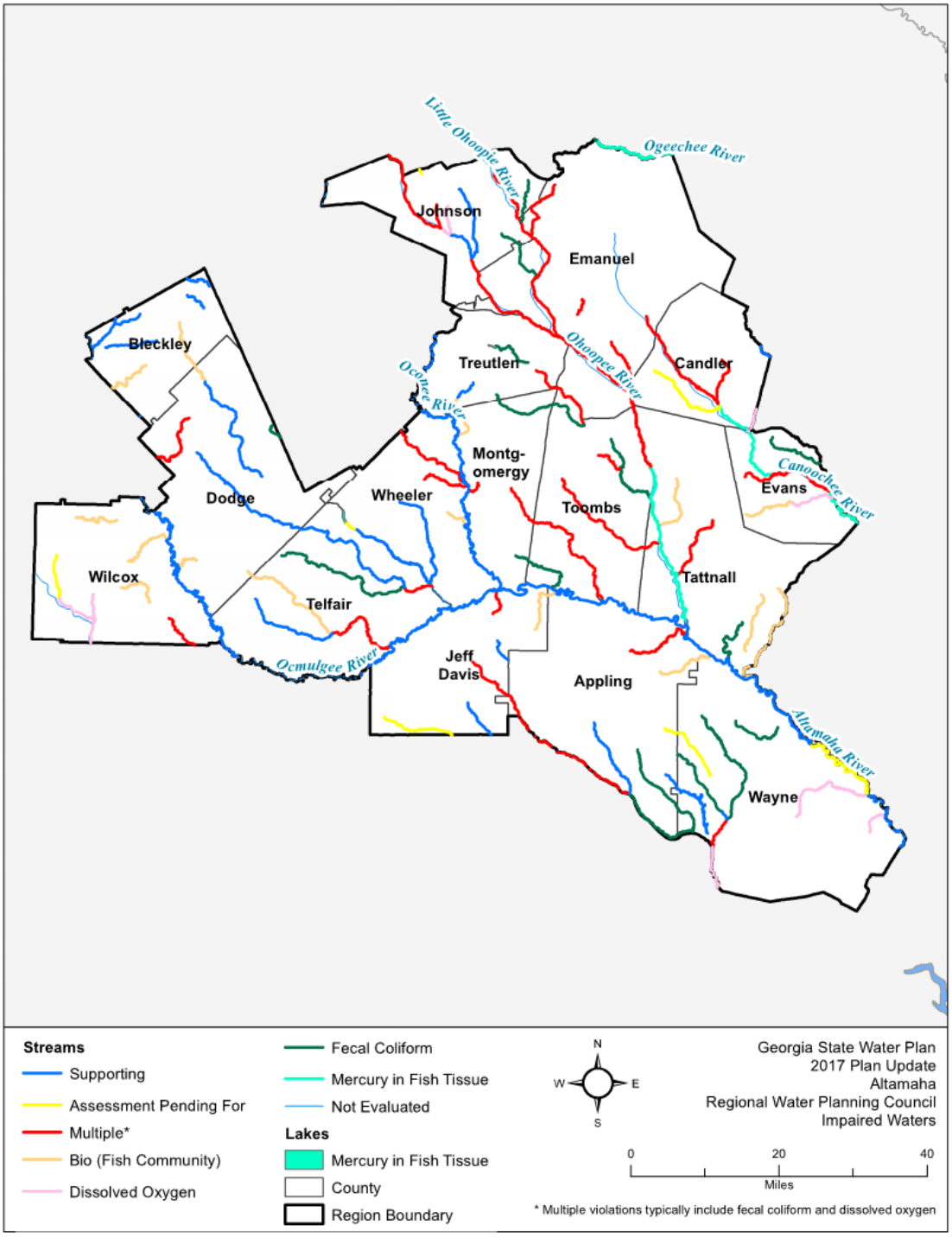
Under Section 303(d) of the federal Clean Water Act (CWA), a total maximum daily load (TMDL) must be developed for waters that do not meet their designated uses. A TMDL represents the maximum pollutant loading that a water body can assimilate and continue meeting its designated use (i.e., not exceeding State water quality standards). A water body is deemed to be impaired if it does not meet the applicable criteria for a particular pollutant; consequently, TMDLs are required to be established for these waters to reduce the concentrations of the exceeding parameters in order to comply with State water quality standards. For the Altamaha Region, there are 74 impaired stream reaches (total impaired length of 755 miles) and 2 impaired lakes (total impaired area of 390 acres).

Of the impaired reaches in the region (note that a reach may be impaired for more than one parameter):

- 30% are impaired for low dissolved oxygen
- 40% are impaired for fecal coliform
- 17% are impaired for Biological (Fish Community)
- 10% are impaired for trophic-weighted residual mercury in fish tissue
- 2% are impaired for lead
- 1% are impaired for pH

Both impaired lakes in the region are impaired for trophic-weighted residual mercury in fish tissue. TMDLs have been completed for 69 of the impaired stream reaches and 2 of the impaired lakes, as shown in Figure 3-8. A full list of impaired waters can be found on the EPD website, http://epd.georgia.gov/georgia-305b303d-list-documents. This list is updated every 2 years by EPD; the above information is based upon the 2014 list.

## Figure 3-8: Impaired Water Bodies with Completed TMDLs



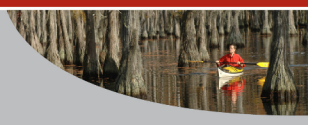
### 3.2.3 Surface Water Availability

**Figure 3-9: Surface Water Planning Nodes**


The Surface Water Availability Resource Assessment (EPD, May 2017) estimates the availability of surface water to meet current and future municipal, industrial, agricultural, and thermal power water needs as well as the needs of instream and downstream users. The assessment evaluated the impact of water consumption (withdrawals from a water body that are not returned to that water body) on stream flows at certain locations in each river basin. Modeled stream flows were compared with a flow regime based on low flow thresholds (from state policy) selected as indicators of the potential for water consumption to impact instream uses such as fishing, boating, and aquatic life habitat. The modeled flow was compared with the flow regime; where the modeled stream flow was less than the flow regime, a potential "gap" was identified. The potential gaps were analyzed in terms of both magnitude (i.e., the amount by which the modeled stream flow fell below the flow regime) and duration (i.e., the number of days the stream flow fell below the flow regime). As shown in Figure 3-9, there are several surface water planning nodes (shown as yellow circles with red triangles) located in the Altamaha Region. Planning nodes are locations along a river where there is a long-term record of river flow measurements. At each node, the surface water availability models applied the current cumulative upstream consumptive uses of water (i.e., withdrawals minus returns) and authorized reservoir operations to stream flows from 1939 to 2013. At these nodes, during certain low flow periods, the model estimates that current off-stream demands cannot be met without causing stream flows to fall below the flow regime.

Surface water is an important resource used to meet current and future needs in the region, especially for the agricultural and energy sectors. Between 2015 and 2050, the use of surface water for agricultural purposes is expected to increase by 4.3 MGD from 36.4 MGD to 40.7 MGD (Altamaha Water and Wastewater Forecasting Technical Memorandum; CDM Smith, 2017). The only planning node within the region with a potential surface water gap is the Claxton node (Canoochee River). However, there are potential surface water gaps outside the region that may be associated with water use within the region.

Modeling of current conditions indicates potential surface water gaps at the Atkinson node in the Satilla River Basin. Surface water uses in three counties (Appling, Jeff



Davis, and Wayne) contribute to surface water runoff to the Satilla River. In the Ogeechee River Basin, there are also potential surface water gaps at the Eden and Kings Ferry nodes. The Kings Ferry node is below the confluence of the Canoochee and Ogeechee Rivers. There is a very small portion of Tattnall County as well as portions of Candler, Emanuel and Evans counties that contribute surface water runoff to the Kings Ferry node. The northern portion of Emanuel County contributes surface water runoff to the Eden node. Finally, there is a potential surface water gap at the Statenville node on the Alapaha River and there is surface water use in a portion of Wilcox County that contributes surface water runoff to the Alapaha River. There were no potential surface water gaps identified at the Doctortown (Altamaha River), Lumber City (Ocmulgee River), and Mount Vernon (Oconee River) nodes. More detailed information about potential gaps at these nodes under future conditions is included in Section 5.

In the Altamaha Region and surrounding area, critical low flow conditions occur on river systems that do not have any upstream storage reservoirs. In these situations, the Surface Water Availability Resource Assessment uses the unimpaired (meaning estimated flows without off-stream uses) monthly 7-day low flow that occurred over a 10-year period or the daily unimpaired flow (whichever is the lowest value) as the low flow thresholds to determine the flow regime. It is important to note that when a potential surface water gap exists, management practices are needed to address times when off-stream uses increase the severity and/or frequency of low flow conditions. Low flow conditions have been and will continue to occur; and the Altamaha Council's management practices are not utilized to address naturally occurring low flow or drought conditions. The results of the current conditions potential gaps are shown in Table 3-2.

**Table 3-2: Summary of Modeled Current Conditions Surface Water Gaps**

| Node | Duration of Gap (% of total days) | Average Flow Deficit | Long-term Average Flow | Maximum 1-Day Gap | Corresponding Flow Regime |
|---|---|---|---|---|---|
| Atkinson | 10 | 24 cfs (16 MGD) | 2,208 cfs (1,427 MGD) | 69 cfs (45 MGD) | 188 cfs (76 MGD) |
| Claxton | 21 | 6 cfs (4 MGD) | 448 cfs (290 MGD) | 16 cfs (10 MGD) | 16 cfs (10 MGD) |
| Eden | 6 | 16 cfs (10 MGD) | 2,207 cfs (1,426 MGD) | 35 cfs (23 MGD) | 139 cfs (90 MGD) |
| Kings Ferry | 6 | 35 cfs (23 MGD) | 3,634 cfs (2,349 MGD) | 81 cfs (52 MGD) | 422 cfs (273 MGD) |
| Statenville | 17 | 26 cfs (17 MGD) | 1,047 cfs (677 MGD) | 89 cfs (58 MGD) | 100 cfs (65 MGD) |

Source: Surface Water Availability Resource Assessment, May 2017, EPD
Note: Surface Water Availability modeling simulation period is from 1939 to 2013

### 3.2.4 Groundwater Availability

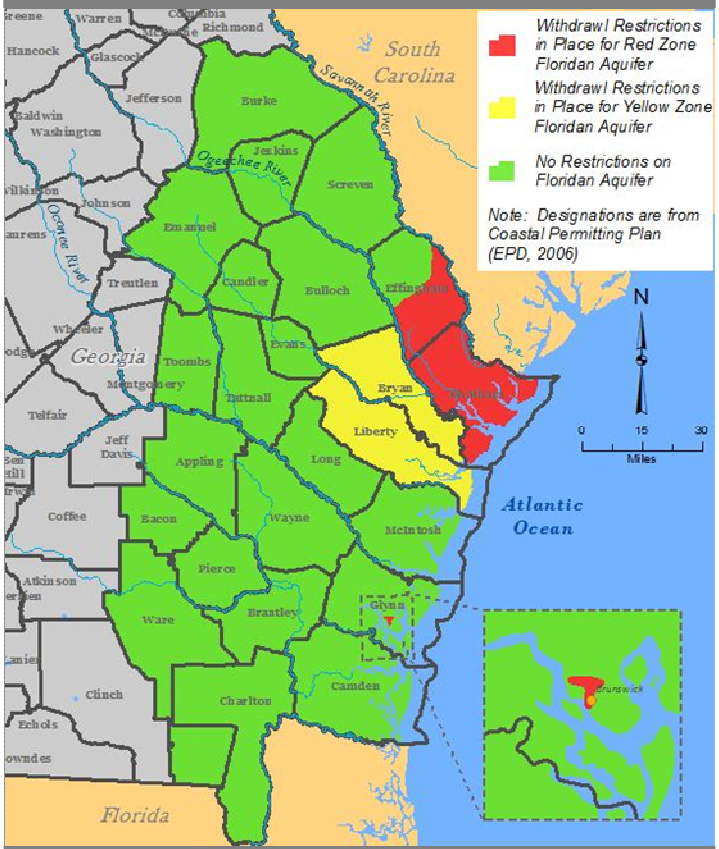
The Groundwater Availability Resource Assessment (EPD) evaluates the amount of water that can be withdrawn from the modeled area of a prioritized aquifer without reaching specific thresholds of local or regional impacts. Indicators of impacts included declines in groundwater levels that may affect neighboring wells (drawdown) and reductions in the amount of groundwater that seeps into streams and thereby contributes to stream flows. The assessment estimates a range of yield that can be withdrawn from an aquifer before specific impacts become evident. The results reflect modeled aquifer responses to specific baseline conditions and specific pumping scenarios.

EPD prioritized the aquifers based on the characteristics of the aquifer, evidence of negative effects, anticipated negative impacts, and other considerations. If negative impacts occur or are expected to occur, then a groundwater "gap" exists.

Groundwater from the Floridan aquifer is a vital resource for the Altamaha Region. In 2010, groundwater was relied upon to meet about 61% of the water use in the region (USGS, 2016). Overall, the results from the Groundwater Availability Resource Assessment indicate that on a regional basis, for the prioritized aquifers, there is sufficient groundwater supply to meet current demands. However, localized issues may occur if groundwater well densities or withdrawal rates are greater than the scenarios evaluated in the Groundwater Availability Resource Assessment.

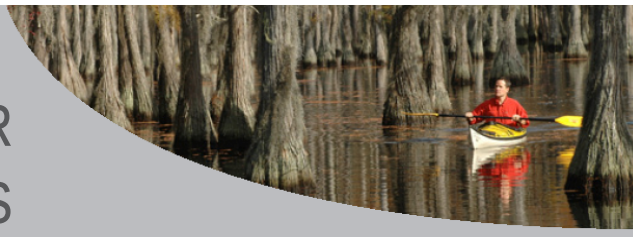
As shown in Figure 3-10, 24 counties in southeast Georgia are subject to the Coastal Georgia Water and Wastewater Permitting Plan for Managing Salt Water Intrusion, June 2006 (Coastal Permitting Plan) (www.gadnr.org/cws/). There are seven counties (Appling, Candler, Emanuel, Evans, Tattnall, Toombs, and Wayne Counties) in the Altamaha Region that are located within the "Green Zone". Per the Coastal Permitting Plan, there are no pumping restrictions from the Floridan aquifer in this area; however, there are several water conservation requirements related to groundwater withdrawals.

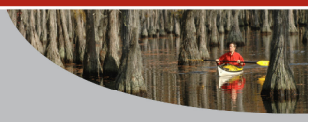
**Figure 3-10: Sub-regions Associated with the Coastal Permitting Plan**




Source: Coastal Georgia Water and Wastewater Permitting Plan for Managing Salt Water Intrusion

# 4. FORECASTING FUTURE WATER RESOURCE NEEDS





# Section 4. Forecasting Future Water Resource Needs

**Summary**

*Over the next 35 years, the population in the Altamaha Region is projected to grow by 11%, increasing the demands for surface water and groundwater and increasing the quantity of wastewater generated.*

*Total water withdrawals by municipal, industrial, agricultural, and energy sectors are projected to increase by 13% (33 MGD) from 2015 to 2050.*

*Total wastewater flows are projected to increase by 10% (10 MGD) over the same period.*

Water and wastewater demand forecasts, along with the Resource Assessments (Section 3), form the foundation for water planning in the Altamaha Region and serve as the basis for the selection of water management practices (Sections 6 and 7). The tables and graphics in this section present the regional water and wastewater forecasts for 2015 through 2050 for four water use sectors: municipal, industrial, agriculture, and thermoelectric generation.

The methodology to forecast water and wastewater demands is based primarily on the assumption that there will be a continuation of existing trends and practices. It does not make a determination regarding the efficiency or inefficiency of forecasted demands, only that they are expected to occur given current trends. Initial forecasting does not take into account management practices, including water conservation (other than passive conservation as described in more detail below) that may be adopted by Regional Water Planning Councils to reduce the expected magnitude of demand (see Sections 6-8 for additional details on water conservation and other management practices). Additionally, this forecasting effort does not change EPD requirements related to individual permitting decisions, but represents a forecast for regional water planning that will help guide permitting and funding decisions.

During development of the Regional Water Plan, there was a concerted effort to strike a balance between broad coverage and local data by using consistent data collection on a regional basis modified as appropriate with local provider input. These data and resulting forecasts are not applicable between regions or between providers within the region.

## 4.1. Municipal Forecasts

Municipal water includes water supplied to residences, commercial businesses, and small industries (water use by higher water using industries are forecasted separately and those major industrial sectors are identified in Section 4.2). Residential water uses include water for normal household purposes: cooking, bathing, and clothes washing, among others. Commercial water uses include water used by hotels, restaurants, retail stores, and office buildings, among others. Municipal water demands may be served by public water systems, private water systems, or self-supplied by the user (such as individual wells).

## Population Projections

Municipal water and wastewater forecasts are closely tied to population projections for the counties within the Altamaha Region. The population projections were developed by the Georgia Governor's Office of Planning and Budget, which is charged in State law (O.C.G.A. § 45-12-171) with the responsibility for preparing, maintaining, and furnishing official demographic data for the State. The population projection results by county for the planning period are shown in Table 4-1.

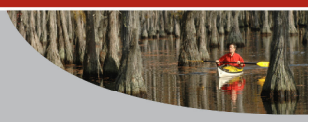
**Table 4-1: Population Projections by County**

| County | 2015 | 2020 | 2030 | 2040 | 2050 | Difference (2015-2050) | % Increase (2015–2050) |
|---|---|---|---|---|---|---|---|
| Appling | 18,693 | 19,311 | 20,429 | 21,341 | 22,405 | 3,712 | 20% |
| Bleckley | 12,817 | 12,894 | 13,073 | 13,462 | 13,823 | 1,006 | 8% |
| Candler | 11,039 | 11,290 | 11,710 | 11,864 | 11,931 | 892 | 8% |
| Dodge | 21,257 | 21,303 | 21,137 | 20,861 | 20,730 | -527 | -2% |
| Emanuel | 23,245 | 24,153 | 25,716 | 26,968 | 28,161 | 4,916 | 21% |
| Evans | 10,930 | 11,166 | 11,627 | 12,043 | 12,557 | 1,627 | 15% |
| Jeff Davis | 15,201 | 15,675 | 16,445 | 16,891 | 17,229 | 2,028 | 13% |
| Johnson | 9,748 | 9,710 | 9,600 | 9,305 | 9,072 | -676 | -7% |
| Montgomery | 9,023 | 9,019 | 8,973 | 8,853 | 8,774 | -249 | -3% |
| Tattnall | 25,896 | 26,787 | 28,351 | 29,933 | 31,940 | 6,044 | 23% |
| Telfair | 16,497 | 16,255 | 15,695 | 15,001 | 14,469 | -2,028 | -12% |
| Toombs | 27,723 | 28,802 | 30,555 | 31,673 | 32,497 | 4,774 | 17% |
| Treutlen | 6,728 | 6,762 | 6,779 | 6,593 | 6,330 | -398 | -6% |
| Wayne | 30,535 | 31,643 | 33,504 | 34,779 | 35,917 | 5,382 | 18% |
| Wheeler | 8,050 | 8,414 | 9,182 | 9,932 | 10,863 | 2,813 | 35% |
| Wilcox | 8,923 | 8,842 | 8,712 | 8,568 | 8,549 | -374 | -4% |
| **Total Altamaha Region** | **256,305** | **262,028** | **271,485** | **278,067** | **285,248** | **28,943** | **11%** |

Source: Georgia Governor's Office of Planning and Budget, 2015.

## Municipal Water Forecasts

The municipal water forecasts were calculated by multiplying the baseline per capita water use by the population served. Per capita water use rates are different for public water systems in comparison to self-supplied water use; therefore, the demands are calculated separately and then summed together. The publicly-supplied water use rate was determined for each county within the region. The self-supply per capita demand is estimated at 75 gallons per capita per day (gpcd).

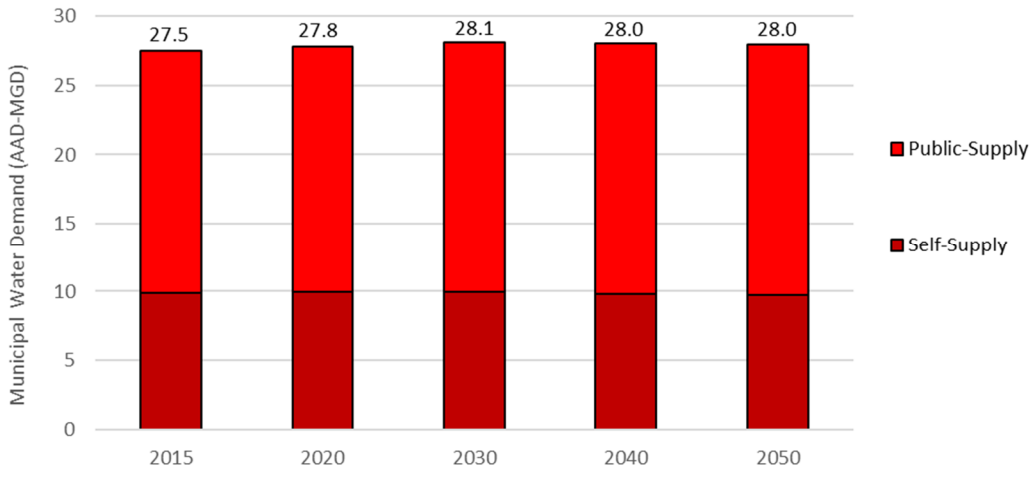


To support this Plan update, EPD reviewed withdrawal data and the estimated population served reported by permitted municipal water systems from the years 2010 through 2014. Based on the trends observed from those data, an adjustment factor for each County was developed and applied to the gallons per capita per day values used in 2010 for public-supplied municipal demand. The self-supplied per capita values remained unchanged.

The forecasted water use rates for the Altamaha Region were also adjusted based on two plumbing code changes that mandate new water saving lavatory fixtures. The National Energy Policy Act of 1992 reduced the maximum toilet flush volume from 3.5 to 1.6 gallons per flush (gpf) for all toilets available in the U.S. starting in 1994. The Georgia Water Stewardship Act of 2010 reduces the maximum flush volume to 1.28 gpf for all new toilets installed in Georgia after July 1, 2012. As new homes are constructed and less efficient toilets are replaced within existing housing stock, the water use rate is reduced over time. Additional information on plumbing code efficiency adjustments and rationale for per capita water use is available in the Altamaha Water and Wastewater Forecasting Technical Memorandum (CDM Smith, 2017).

Total regional municipal water demands are shown in Figure 4-1 for the Altamaha Region. In addition, this figure shows the distribution in demands resulting from public water systems and self-supply systems. In the Altamaha Region, all municipal water demands are satisfied by utilizing groundwater as the sole source for withdrawals.

**Figure 4-1: Total Municipal Water Use Forecast (in AAD-MGD)**




Source: Altamaha Water and Wastewater Forecasting Technical Memorandum (2017)
Note: Values represent forecasted annual average demand (AAD) in million of gallons per day (MGD)

## Municipal Wastewater Forecasts

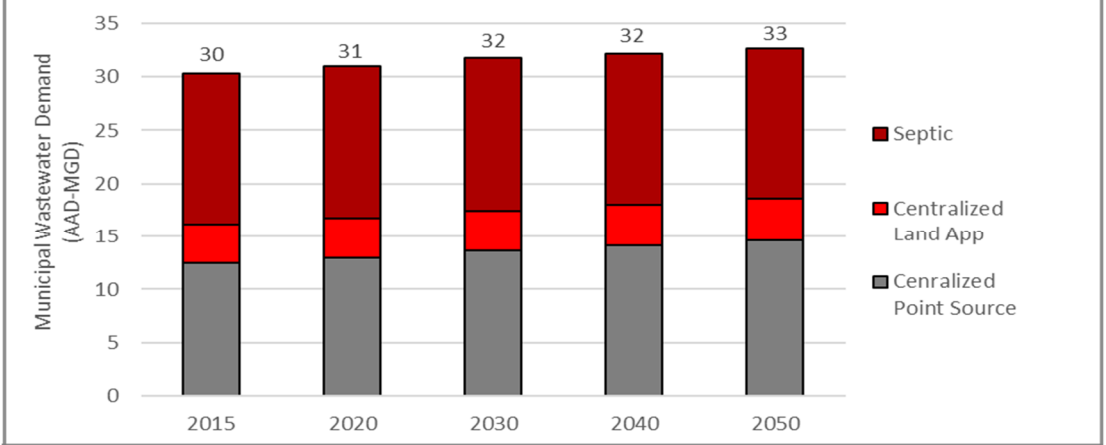
Municipal wastewater forecasts are based on estimates of indoor municipal (public and self-supplied) water use. Indoor water use may be treated by centralized treatment plants or onsite sanitary sewage (septic) systems. Centralized treatment plants may discharge to a water body or to a land application system (LAS).

In 2010, estimates of wastewater generated from publicly-supplied and self-supplied water use were calculated and then assigned to septic and centralized wastewater flows. U.S. Census data on the percent of households with septic systems were obtained by county. For planning purposes, it was estimated that all the wastewater generated from self-supplied water use is disposed of via septic system. Dividing the number of municipally supplied households on septic by the U.S. Census estimate of the number of households by county provided an estimate of the percent of municipally supplied households that discharged to septic systems.

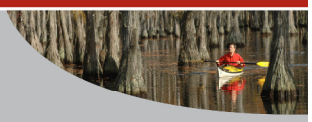
Wastewater effluent flow from centralized treatment facilities is either discharged as a point source to a receiving water body or delivered to an LAS. EPD permit data as well as feedback from municipal suppliers were used to determine the ratio of point discharge to land application system for each county.

For this Plan update, the percent of county total wastewater flow that is septic was retained, with the septic flow forecast adjusted based on the percent change in county population between the prior (2010) and updated (2015) OPB population projections. Centralized wastewater flows from 2014, including point discharges and LAS, were analyzed. The sum of the 2014 point discharges per county was adjusted based on any adjustment in the ratio of septic/centralized treatment over time as well as the population projections. Similarly, the sum of 2014 LAS flows by county was adjusted based on the ratio of septic/centralized treatment over time and the population projections. Municipal wastewater forecasts are shown in Figure 4-2.

**Figure 4-2: Total Municipal Wastewater Generation Forecast (in AAD-MGD)**




Source: Altamaha Water and Wastewater Forecasting Technical Memorandum (2017)
Note: Values represent forecasted annual average demand (AAD) in million of gallons per day (MGD)



## 4.2. Industrial Forecasts

Industrial forecasts show the future need from the major water using industries including: food, textile, and paper. Industries require water for processes, sanitation, cooling, and other purposes, in addition to domestic (employee) water use. Some industries, such as poultry processors, operate under strict U.S. Department of Agriculture guidelines that require water use to maintain sanitary conditions within the facilities. Water need (i.e., the total water requirements of an industry, or the water withdrawals) is based on either production or employment, depending on the available information.

### Employment Projections

The employment projections provided information on the anticipated employment growth rate for each industrial sector. The University of Georgia produced the industry-specific rates of growth for employment for EPD, which were then used to calculate the future water needs for specific industries within the Altamaha Region. General employment in heavy water-using industries such as textile and paper sectors shows an upward trend throughout the planning period, while employment projections in the food manufacturing sector are maintained relatively constant.

### Industrial Water Forecasts

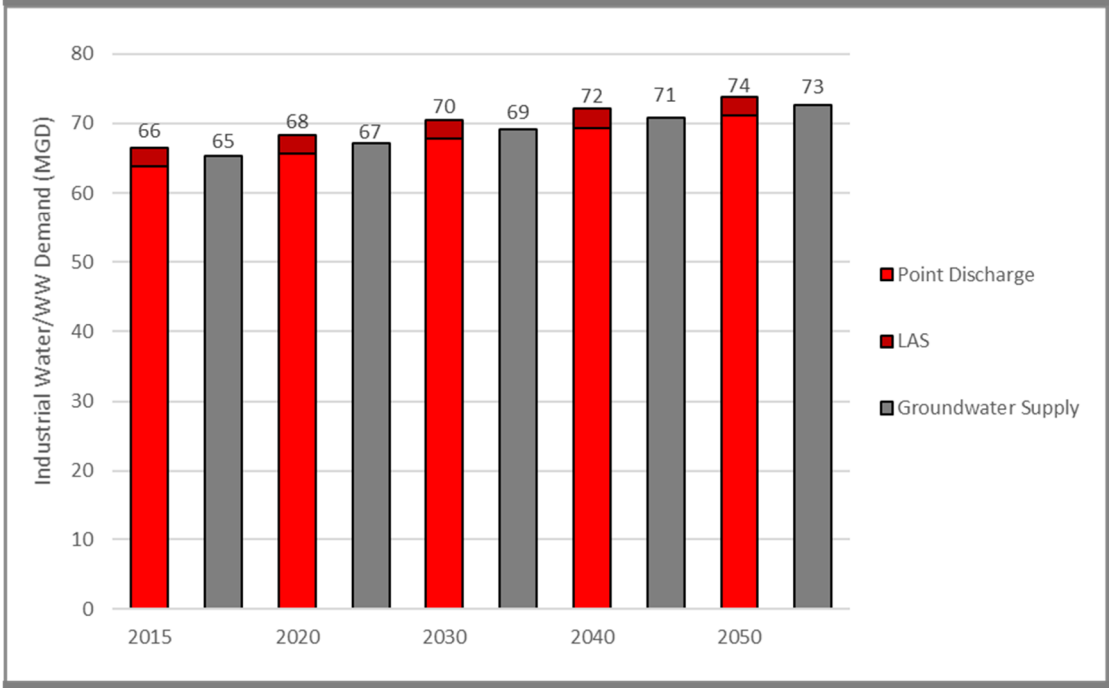
Industrial water forecasts were not updated as part of this Plan update and were originally calculated using information and data specific to each of the major water using industries. For industries where information was available on water use per unit of production, water forecasts were based on production. For industries where product based forecasts were not possible, industry-specific workforce projections were assumed to reflect the anticipated growth in water use within the industry. Figure 4-3 shows the industrial water and wastewater forecast over the planning period. Similar to the municipal water demands, industrial demands in the Altamaha Region are fully satisfied by utilizing groundwater as the sole source for withdrawals.

### Industrial Wastewater Forecasts

Industrial wastewater forecasts were not updated as part of this Plan update and were originally calculated for each sector by multiplying the industrial water use by the ratio of wastewater to water for that industrial sector. For example in the apparel category, for every gallon of water used, there will be 0.6 gallons of wastewater produced. For the paper category, for every gallon of water used, there will be 1.0 gallon of wastewater produced.

Once the industrial wastewater flows were estimated, flows were separated between point discharges and land application. The industrial wastewater forecasts are presented in Figure 4-3 by the anticipated disposal system type: industrial wastewater treatment (point discharge), LAS, or discharge for municipal wastewater treatment.

**Figure 4-3: Total Industrial Water and Wastewater Forecast (in AAD-MGD)**




Source: Altamaha Water and Wastewater Forecasting Technical Memorandum (2017)
Note: Values represent forecasted annual average demand (AAD) in million gallons per day (MGD)

## 4.3. Agricultural Forecasts

The agricultural water use forecasts include irrigation demands for both crop and non-crop uses (i.e., livestock, nurseries, and golf courses). The crop forecasts, developed by the Georgia Water Planning & Policy Center at Albany State University (GWPPC), with support from the University of Georgia's (UGA) College of Agricultural and Environmental Sciences for 2015 through 2050, provide a range of irrigation water use from dry to wet climate conditions based on the acres irrigated for each crop. Table 4-2 lists a drier-than-normal year crop irrigation forecast for each county.

Non-crop (including non-permitted) agricultural water demands were identified with the assistance of industry associations. Similar to crop irrigation, forecasts for nursery and greenhouse water use were also developed for a range of climate conditions over the planning period. For planning purposes, the drier-than-normal nursery/greenhouse forecasts are presented in Table 4-2. For golf courses and livestock production, current water forecasts were developed, but future forecasts were not developed due to lack of available data. Current water demands were held constant throughout the planning period for these water use sectors.

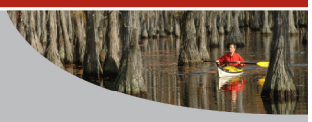


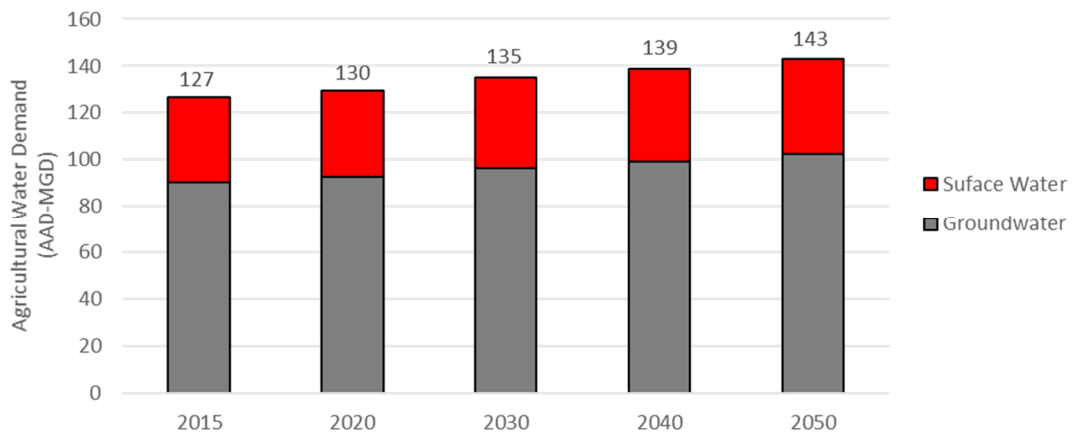
Figure 4-4 shows the regional agricultural demands by source of supply. A 13% increase in agricultural water demand is projected by 2050 for the Altamaha Region. The largest increase in forecasted demand occurs in Montgomery County, with a 29% increase by 2050. Candler, Appling, and Tattnall Counties have the next largest forecasted demand increases at 25%, 23% and 21%, respectively. All other counties in the region are forecasted to have increases of less than 20% through 2050, with Treutlen and Johnson Counties having the smallest increases at 1% and -3%, respectively. As shown in Figure 4-4, the majority of the agricultural withdrawals (over 70%) are supplied by groundwater and the remainder by surface water.

**Table 4-2: Agricultural Water Forecast by County (in AAD-MGD)**

| County | 2015 | 2020 | 2030 | 2040 | 2050 | % Change |
|---|---|---|---|---|---|---|
| Appling | 6.5 | 6.7 | 7.2 | 7.6 | 8.0 | 23% |
| Bleckley | 12.5 | 12.6 | 12.9 | 13.0 | 13.1 | 5% |
| Candler | 5.2 | 5.4 | 5.8 | 6.1 | 6.4 | 25% |
| Dodge | 12.6 | 12.9 | 13.4 | 13.7 | 14.0 | 11% |
| Emanuel | 4.7 | 4.7 | 4.9 | 5.0 | 5.1 | 9% |
| Evans | 5.2 | 5.2 | 5.4 | 5.6 | 5.8 | 12% |
| Jeff Davis | 6.6 | 6.6 | 6.7 | 6.7 | 6.7 | 2% |
| Johnson | 3.3 | 3.3 | 3.3 | 3.2 | 3.2 | -3% |
| Montgomery | 4.2 | 4.4 | 4.7 | 5.1 | 5.4 | 29% |
| Tattnall | 16.5 | 17.1 | 18.1 | 19.0 | 20.0 | 21% |
| Telfair | 10.6 | 10.9 | 11.5 | 12.0 | 12.4 | 17% |
| Toombs | 11.6 | 11.8 | 12.1 | 12.4 | 12.7 | 10% |
| Treutlen | 1.8 | 1.9 | 1.9 | 1.9 | 1.9 | 1% |
| Wayne | 3.6 | 3.6 | 3.7 | 3.8 | 3.8 | 8% |
| Wheeler | 3.5 | 3.6 | 3.6 | 3.7 | 3.7 | 5% |
| Wilcox | 18.6 | 18.9 | 19.7 | 20.3 | 20.9 | 12% |
| **Total** | **126.7** | **129.6** | **134.9** | **138.9** | **142.9** | **13%** |

Source: Altamaha Water and Wastewater Forecasting Technical Memorandum (2017)
Note: Crop demands represent dry year conditions, in which 75% of years had more rainfall and 25% of years had less.
Agricultural withdrawals (crop and non-crop) are supplied by groundwater and surface water.
AAD-MGD: average annual demand represented as million gallons per day

**Figure 4-4: Total Agricultural Water Use Forecast (in AAD-MGD)**




Source: Altamaha Water and Wastewater Forecasting Technical Memorandum (2017)
Note: Values represent forecasted annual average demand (AAD) in million gallons per day (MGD)

## 4.4. Water for Thermoelectric Power Forecasts

Thermoelectric water withdrawal and consumption demands were developed for the State of Georgia based on forecasted power generation needs and assumptions regarding future energy generation processes.

Thermoelectric water demands for the Altamaha Region are shown in Table 4-3. The forecast analysis covers both water withdrawal requirements and water consumption associated with energy generation. Information related to water withdrawals is an important consideration in planning for the water needed for energy production. However, water consumption is the more important element when assessing future resources because a large volume of water is typically returned to the environment following the energy production process. The only current or planned facility that is explicitly part of the analysis in the Altamaha Region is the Edwin I. Hatch Nuclear Power Plant.

Within the previous statewide analysis, the generating capacity of the existing and planned facilities was not able to meet the projected statewide power needs through 2050 and additional generating capacity was assumed to be developed beyond 2020. The Altamaha Region had assumed a portion of this future generation could occur in their region. In the updated analysis, additional generating capacity may be needed to meet the statewide power need estimate. However, the water requirements associated with the potential new capacity are minimal; less than 20 MGD withdrawals and less than 10 MGD consumption, statewide. Thus, no future water demands for currently unassigned power generation facilities have been added to the estimates for the Altamaha Region.

| Table 4-3: Regional Thermoelectric Water Forecasts (in AAD-MGD) | | | | | |
|---|---|---|---|---|---|
| **Category** | **2015** | **2020** | **2030** | **2040** | **2050** |
| Existing and Planned Facilities' Withdrawals | 54 | 54 | 55 | 60 | 68 |
| Existing and Planned Facilities' Consumption | 35 | 34 | 35 | 39 | 44 |

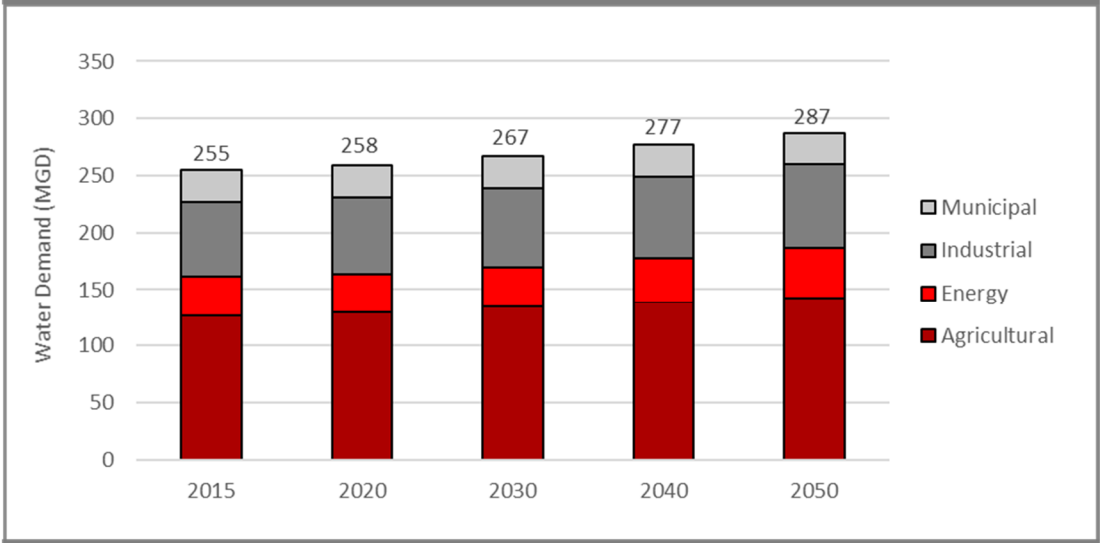
Source: Memorandum: Update of GA Energy Needs & Generating Facilities (2016)
AAD-MGD: average annual demand represented as million gallons per day

## 4.5. Total Water Demand Forecasts

Total water demand forecasts for the years 2015-2050 for the Altamaha Region are summarized in Figure 4-5. This figure presents the forecasts for municipal, industrial, agricultural, and thermoelectric power. Overall, the water demands in the region are expected to grow by 13% (33 MGD) from 2015 through 2050.

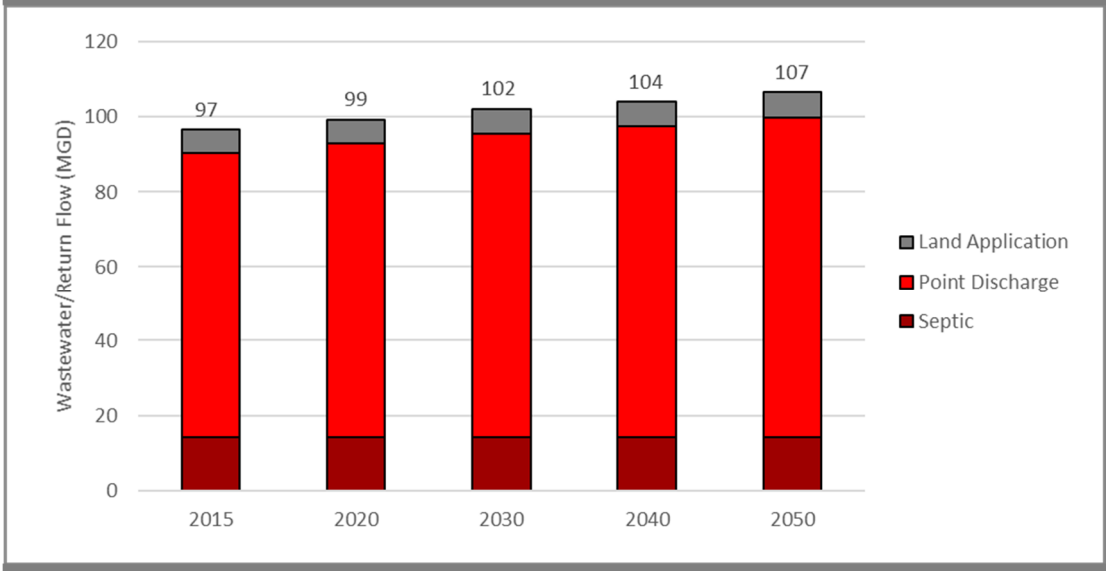
Figure 4-6 summarizes total wastewater forecasts from 2015 through 2050 for the Altamaha Region. This figure presents the forecasts by the anticipated disposal system type: point discharge, LAS, or discharge into a septic system. Overall, wastewater flows in the region are expected to grow by 10% (10 MGD) from 2015 through 2050.

**Figure 4-5: Water Demand Forecast per Sector (in AAD-MGD)**

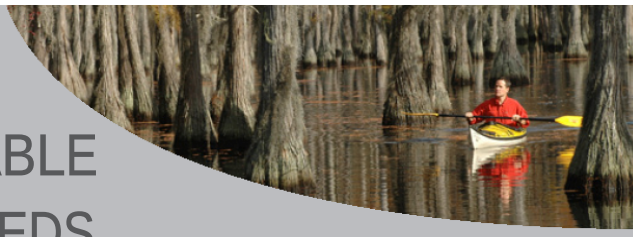



Source: Altamaha Water and Wastewater Forecasting Technical Memorandum (2017)
Notes: The total shown above includes estimated consumptive demand for energy production as well as dry year agricultural demands (75th percentile demands). Values represent forecasted annual average demand (AAD) in million gallons per day (MGD).

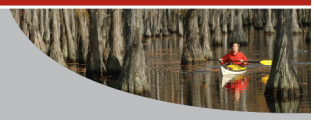
**Figure 4-6: Total Wastewater Forecast (in AAD-MGD)**




Source: Altamaha Water and Wastewater Forecasting Technical Memorandum (2017)
Note: Values represent forecasted annual average demand (AAD) in million gallons per day (MGD)



# 5. COMPARISON OF AVAILABLE RESOURCE CAPACITY AND FUTURE NEEDS



# Section 5. Comparison of Available Resource Capacity and Future Needs

This Section compares the water and wastewater demand forecasts (Section 4), along with the Resource Assessments (Section 3), providing the basis for selecting water management practices (Sections 6 and 7). Areas where future demands exceed the estimated capacity of the resource have a gap that will be addressed through water management practices. This Section summarizes the gaps and water supply needs for the Altamaha Region.

**Summary**

*Over the next 35 years, forecasted surface water demand within the Altamaha Region is projected to exceed the available resource in the Canoochee River at the Claxton planning node based on modeling analysis. Increased demand in the region may also add to modeled surface water gaps downstream of the region on the Ogeechee River at the Kings Ferry, Eden planning nodes, the Satilla River at the Atkinson node, and the Alapaha River at the Statenville node.*

*At the regional level, for modeled aquifers, no groundwater resource shortfalls are expected to occur in the Altamaha Region over the planning horizon.*

*Assimilative capacity assessments indicate the need for improved wastewater treatment in some facilities within the Altamaha, Ocmulgee, Ogeechee, and Suwannee river basins.*

*Addressing non-point sources of pollution and existing water quality impairments will be a part of addressing the region's future needs.*

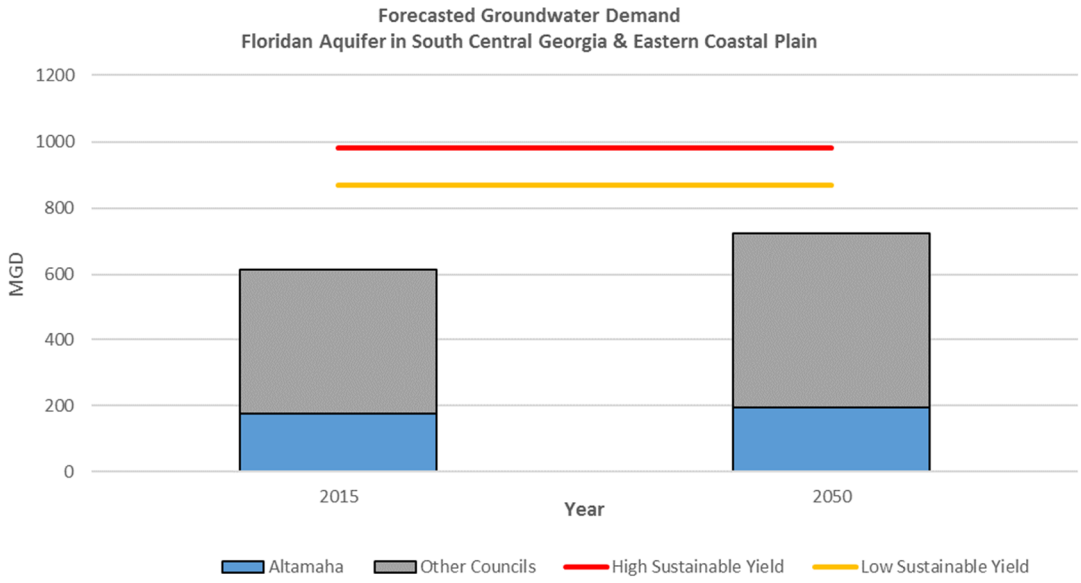
## 5.1. Groundwater Availability Comparisons

Groundwater from the Floridan aquifer is a vital resource for the Altamaha Region. Overall, the results from the Groundwater Availability Resource Assessment (EPD, March 2010) indicate that the estimated range of sustainable yield for the modeled portions of the regional aquifer(s) is greater than the updated forecasted demands (see Figure 5-1).

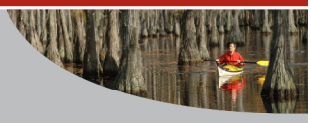
At this time, no regional groundwater resource gaps are expected to occur in the Altamaha Region over the planning horizon. However, localized gaps could occur if well densities and/or withdrawal rates result in exceedance of sustainable yield metrics. In addition, some counties including Emanuel, Evans, Jeff Davis, and Wheeler Counties may need additional permitted capacity if future demand for groundwater exceeds permitted groundwater withdrawal limits. The comparison of existing groundwater permitted capacity to forecasted future demand in the Altamaha Region is shown in Table 5-1. Please note that sufficient capacity at the county level does not preclude localized municipal permit capacity shortages.

Local water providers in counties with large demand forecasts should review their permitting needs.

## Figure 5-1: Floridan Aquifer Demand vs. Estimated Yield




Sources:
Groundwater Availability Assessment, January 2011, EPD
Altamaha Water and Wastewater Forecasting Technical Memorandum, 2017, CDM Smith.
Other regions utilizing portions of the modeled Floridan aquifer to meet demand include: Coastal Georgia, Middle Ocmulgee, Suwannee-Satilla, Savannah-Upper Ogeechee, Upper Oconee, Lower Flint-Ochlockonee, and Upper Flint.



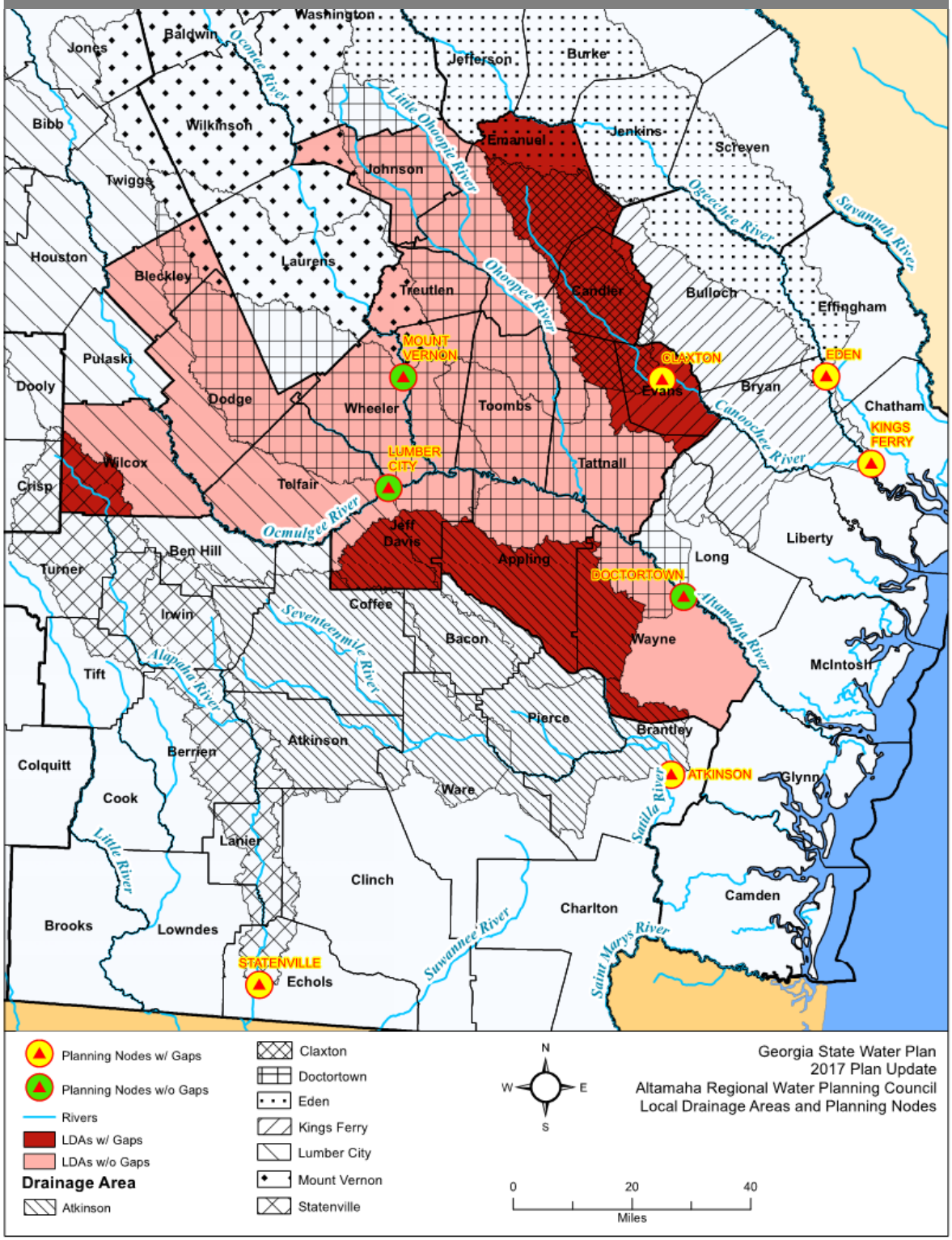
| Table 5-1: 2050 Municipal Forecast versus Groundwater Permitted Capacity | | | | |
|---|---|---|---|---|
| County | 2015 Public Demand Forecast (AAD – MGD) | 2050 Public Demand Forecast (AAD – MGD) | Existing Permitted Capacity (AAD – MGD) | Additional Permitted Capacity Needed in 2050 (AAD – MGD)* |
| Appling | 0.93 | 1.04 | 1.40 | - |
| Bleckley | 0.64 | 0.64 | 2.15 | - |
| Candler | 0.47 | 0.46 | 0.90 | - |
| Dodge | 1.40 | 1.29 | 3.05 | - |
| Emanuel | 2.03 | 2.31 | 1.95 | 0.36 |
| Evans | 0.52 | 0.54 | 0.50 | 0.04 |
| Jeff Davis | 1.40 | 1.51 | 0.85 | 0.66 |
| Johnson | 0.50 | 0.43 | 0.85 | - |
| Montgomery | 0.62 | 0.55 | 0.80 | - |
| Tattnall | 1.23 | 1.39 | 3.37 | - |
| Telfair | 1.59 | 1.30 | 2.03 | - |
| Toombs | 2.70 | 2.96 | 5.00 | - |
| Treutlen | 0.40 | 0.35 | 0.65 | - |
| Wayne | 2.15 | 2.40 | 2.63 | - |
| Wheeler | 0.38 | 0.48 | 0.40 | 0.08 |
| Wilcox | 0.67 | 0.60 | 0.91 | - |

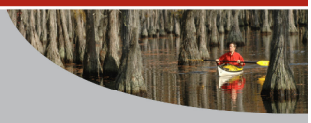
*Analysis does not account for demands in one county that may be met by permits from another county.
Values provided are average annual demands in millions of gallons per day (AAD-MGD)

## 5.2. Surface Water Availability Comparisons

Surface water is an important resource used to meet current and future needs of the Altamaha Region, especially in the agricultural and energy sectors. There are several surface water planning nodes located in and in close proximity to the Altamaha Region. From the updated Surface Water Availability Resource Assessment (EPD, 2017), the basic conclusions of the future conditions modeling show potential surface water gaps (i.e., times when there is insufficient water to meet off-stream demands and also meet the targets for support of instream uses based on the modeling analysis) at the following nodes: Claxton (Canoochee River), Eden (Ogeechee River, outside of Altamaha Region), Kings Ferry (Ogeechee River, outside of Altamaha Region), Atkinson (Satilla River, outside of Altamaha Region) and Statenville (Alapaha River outside of the Altamaha Region). The location of these planning nodes and the portion of the Altamaha Region that is within the local drainage area (LDA) are shown in Figure 5-2. A summary of the modeled potential surface water gaps in 2050 is provided in Table 5-2. The darker shading within the Altamaha region indicate the areas that drain to a planning node with potential surface water gaps.

## Figure 5-2: 2050 Potential Surface Water Gap Summary





| Table 5-2: Summary of Modeled 2050 Potential Surface Water Gaps | | | | | |
|---|---|---|---|---|---|
| Node | Duration of Gap (% of total days) | Average Flow Deficit | Long-term Average Flow | Maximum 1-Day Gap | Corresponding Flow Regime |
| Atkinson | 5 | 20 cfs (13 MGD) | 2,236 cfs (1,445 MGD) | 42 cfs (27 MGD) | 85 cfs (55 MGD) |
| Claxton | 15 | 5 cfs (3 MGD) | 452 cfs (292 MGD) | 15 cfs (10 MGD) | 15 cfs (10 MGD) |
| Eden | 3.3 | 24 cfs (16 MGD) | 2,213 cfs (1,430 MGD) | 47 cfs (30 MGD) | 102 cfs (66 MGD) |
| Kings Ferry | 3 | 37 cfs (24 MGD) | 3,658 cfs (2,364 MGD) | 80 cfs (52 MGD) | 247 cfs (160 MGD) |
| Statenville | 12 | 32 cfs (21 MGD) | 1,058 cfs (684 MGD) | 77 cfs (50 MGD) | 77 cfs (50 MGD) |

Source: Surface Water Availability Resource Assessment, May 2017, EPD
Note: Surface Water Availability modeling simulation period is from 1939 to 2013

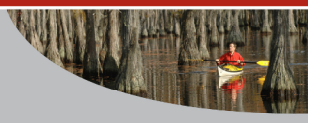
When assessing this issue, the Altamaha Council recognized that modeled surface water gaps are driven by both net consumption (withdrawal minus returns) and year to year variations in river flows. In wet years, the region is not likely to experience any potential gaps to instream needs. In dry years, the potential gaps are likely to be more severe. In order to better assess these potential gaps and to better understand the types of management practices that may be required, a more detailed quantification of the frequency and severity of modeled potential surface water gaps was completed.

The quantification and frequency of potential gaps is especially relevant when selecting water management practices. For example, if the preferred management practice is to replace surface water diversions with groundwater withdrawals, it is important to know how much flow should be generated and for what length of time. This process will in turn dictate the number and size of wells needed to generate the flow. If a reservoir is the preferred practice, then one needs to know the largest volume of storage that may be needed because stream flow needs can then be addressed by controlling the rate of flow released from the reservoir. In addition, since the largest potential gaps occur less frequently, there are important cost-benefit considerations associated with addressing the largest and more infrequent potential gaps. The quantification and frequency of the modeled potential gaps are provided in Table 5-3. It is important to note that the majority of the modeled potential gaps were shorter in duration (1 to 7 day and 8 to 14 day potential gaps events). The more infrequent and severe gaps are indicative of drought conditions and will most likely be addressed through drought management measures implemented by EPD and users in the region.

| Table 5-3: Characteristics of Modeled 2050 Potential Surface Water Gaps | | | | | | |
|---|---|---|---|---|---|---|
| Gap Event Duration | Number of Gap Events (% of Total Gap Events)[1] | | Total Gap Days (% of Total Days)[2] | | Average Daily Flow Deficit per Event | Average Cumulative Flow Deficit per Event |
| **Atkinson Node** | | | | | | |
| 1-7 days | 43 | (51.2%) | 146 | (0.5%) | 9 cfs (6 MGD) | 35 cfsd (23 MG) |
| 8-14 days | 11 | (13.1%) | 109 | (0.4%) | 16 cfs (10 MGD) | 158 cfsd (103 MG) |
| 15-30 days | 17 | (20.2%) | 403 | (1.5%) | 21 cfs (14 MGD) | 498 cfsd (324 MG) |
| >30 days | 13 | (15.5%) | 608 | (2.2%) | 22 cfs (14 MGD) | 1,031 cfsd (670 MG) |
| Totals | 84 | (100.0%) | 1266 | (4.6%) | | |
| **Claxton Node** | | | | | | |
| 1-7 days | 139 | (51.7%) | 482 | (1.8%) | 3 cfs (2 MGD) | 13 cfsd (8 MG) |
| 8-14 days | 55 | (20.4%) | 598 | (2.2%) | 5 cfs (3 MGD) | 56 cfsd (36 MG) |
| 15-30 days | 39 | (14.5%) | 851 | (3.1%) | 6 cfs (4 MGD) | 123 cfsd (80 MG) |
| >30 days | 36 | (13.4%) | 2181 | (8.0%) | 6 cfs (4 MGD) | 335 cfsd (218 MG) |
| Totals | 269 | (100.0%) | 4112 | (15.0%) | | |
| **Eden Node** | | | | | | |
| 1-7 days | 44 | (61.1%) | 178 | (0.6%) | 11 cfs (7 MGD) | 52 cfsd (34 MG) |
| 8-14 days | 12 | (16.7%) | 114 | (0.4%) | 15 cfs (10 MGD) | 150 cfsd (98 MG) |
| 15-30 days | 10 | (13.9%) | 222 | (0.8%) | 29 cfs (19 MGD) | 633 cfsd (411 MG) |
| >30 days | 6 | (8.3%) | 388 | (1.4%) | 28 cfs (18 MGD) | 1,795 cfsd (1,167 MG) |
| Totals | 72 | (100.0%) | 902 | (3.3%) | | |
| **Kings Ferry Node** | | | | | | |
| 1-7 days | 40 | (58.0%) | 137 | (0.5%) | 20 cfs (13 MGD) | 82 cfsd (530MG) |
| 8-14 days | 9 | (13.0%) | 98 | (0.4%) | 41 cfs (27 MGD) | 468 cfsd (302 MG) |
| 15-30 days | 13 | (18.8%) | 291 | (1.1%) | 57 cfs (37 MGD) | 1,264 cfsd (817 MG) |
| >30 days | 7 | (10.1%) | 413 | (1.5%) | 75 cfs (49 MGD) | 4,363 cfsd (2,820 MG) |
| Totals | 69 | (100.0%) | 939 | (3.4%) | | |
| **Statenville Node** | | | | | | |
| 1-7 days | 91 | (48.4%) | 298 | (1.1%) | 9 cfs (6 MGD) | 37 cfsd (24 MG) |
| 8-14 days | 37 | (19.7%) | 405 | (1.5%) | 21 cfs (14 MGD) | 229 cfsd (149 MG) |
| 15-30 days | 27 | (14.4%) | 554 | (2.0%) | 26 cfs (17 MGD) | 536 cfsd (348 MG) |
| >30 days | 33 | (17.6%) | 2044 | (7.5%) | 38 cfs (25 MGD) | 2,444 cfsd (1,589 MG) |
| Totals | 188 | (100.0%) | 3301 | (12.1%) | | |

[1] The total number of modeled gap events is presented for each duration range, as well as the percentage in that duration range to the total number of all modeled gap events.

[2] The total number of days within the modeling period (1939-2013) in which a potential gap occurred is presented, as well as the percentage of that total to the total number of days analyzed in the modeling period.



The projected increased use of surface water for the counties within the Altamaha Region that have potential current and future modeled gaps is shown in Table 5-4. Since there are current modeled gaps at the referenced planning nodes, development of additional surface water to meet projected needs will need to done in a manner that does not increase potential gaps.

**Table 5-4: 2050 Increased Annual Average Surface Water Demand within Potential Gap Areas**

| County | Planning Node with Potential Gap | Increase in Agricultural Demand by 2050[1] (MGD) | Increase in Agricultural Demand by 2050[1] (cfs) |
|---|---|---|---|
| Appling | Atkinson | 0.10 | 0.16 |
| Candler | Claxton | 0.49 | 0.75 |
| | Kings Ferry | 0.002 | 0.00 |
| Emanuel | Claxton | 0.07 | 0.10 |
| | Eden | 0.01 | 0.01 |
| | Kings Ferry | 0.01 | 0.01 |
| Evans | Claxton | 0.04 | 0.07 |
| | Kings Ferry | 0.08 | 0.12 |
| Jeff Davis | Atkinson | 0.03 | 0.04 |
| Tattnall | Claxton | 0.09 | 0.13 |
| | Kings Ferry | 0.08 | 0.12 |
| Wayne | Atkinson | 0.01 | 0.01 |
| Wilcox | Statenville | 0.12 | 0.19 |

[1]All surface water demands within the planning node drainage areas are agricultural.

## 5.3. Surface Water Quality Comparisons (Assimilative Capacity)

This Section summarizes the results of the Water Quality (Assimilative Capacity) Resource Assessment modeling when all municipal and industrial wastewater treatment facilities operate at permit conditions, and provides a comparison of existing wastewater permitted capacity to the projected 2050 wastewater forecast flows. A discussion on non-point source pollution is also included.

### Future Treatment Capacity Needs

Existing municipal wastewater permitted capacities were compared to projected 2050 wastewater flows to estimate future treatment capacity needs by county. This analysis was done for both point sources and LAS that are permitted under the National Pollutant Discharge Elimination System (NPDES) or state LAS permits. As

shown in Table 5-5, no counties are projected to exceed their permitted capacity by 2050. It should be noted that the comparison in Table 5-5 was completed at the county level and localized shortages in treatment capacity may exist.

**Table 5-5: 2050 Municipal Wastewater Forecast versus Existing Permitted Capacity (MGD)**

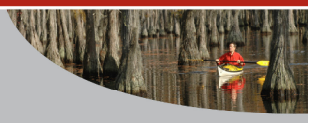
| County | Point Source (PS) | | | Land Application Systems (LAS) | | |
|---|---|---|---|---|---|---|
| | 2050 Forecast[1] | Permitted Capacity | 2050 Surplus or Gap (-) | 2050 Forecast[1] | Permitted Capacity | 2050 Surplus or Gap (-) |
| Appling | 1.23 | 2.80 | 1.57 | 0 | 0 | 0 |
| Bleckley | 0.49 | 1.00 | 0.51 | 0 | 0 | 0 |
| Candler | 0 | 0 | 0 | 0.60 | 1.00 | 0.40 |
| Dodge | 0.64 | 1.80 | 1.16 | 0.32 | 0.50 | 0.18 |
| Emanuel | 2.87 | 3.01 | 0.14 | 0.29 | 1.00 | 0.71 |
| Evans | 0.05 | 0.52 | 0.47 | 0.05 | 0.22 | 0.17 |
| Jeff Davis | 0.84 | 1.50 | 0.66 | 0 | 0 | 0 |
| Johnson | 0.55 | 0.75 | 0.20 | 0 | 0 | 0 |
| Montgomery | 0.34 | 0.35 | 0.01 | 0.03 | 0.15 | 0.12 |
| Tattnall | 2.01 | 2.91 | 0.90 | 0.31 | 0.74 | 0.43 |
| Telfair | 0.55 | 1.30 | 0.75 | 0.70 | 1.80 | 1.10 |
| Toombs | 1.51 | 3.23 | 1.72 | 1.48 | 1.80 | 0.32 |
| Treutlen | 0.39 | 0.60 | 0.21 | 0 | 0 | 0 |
| Wayne | 2.36 | 2.50 | 0.14 | 0.14 | 0.18 | 0.04 |
| Wheeler | 0.59 | 1.04 | 0.45 | 0.09 | 0.21 | 0.13 |
| Wilcox | 0.20 | 0.67 | 0.47 | 0 | 0 | 0 |
| **Total** | **14.62** | **23.96** | **9.35** | **4.00** | **7.59** | **3.59** |

[1] Includes industrial wastewater expected to be treated at municipal facilities.

## Assimilative Capacity Assessments

The Water Quality (Assimilative Capacity) Resource Assessment drew upon water quality modeling tools to estimate the ability of streams and estuaries to assimilate pollutants under current and future conditions. The modeling focused on instream dissolved oxygen (DO) and incorporated all municipal and industrial wastewater facilities operating at their full permitted discharge levels (flow and effluent discharge limits as of 2014). The results of the DO modeling at current permitted conditions are presented in Figure 5-3 and Table 5-6 for the Altamaha Region, which includes portions of the Altamaha, Oconee, Ocmulgee, and Ogeechee River basins.

The results show the modeled effects of oxygen-demanding compounds in wastewater and other factors on instream DO levels. A stream segment with “none or exceeded” available assimilative capacity (denoted as red lines in Figure 5-3) has



estimated instream DO levels that are at or below the DO water quality criteria and therefore indicate conditions of no available assimilative capacity or exceeded assimilative capacity. It is important to note that an exceedance of DO assimilative capacity on a stream segment could be the result of a point source discharge, non-point source loading, or a naturally low instream DO condition. Reaches within the Altamaha Planning Council that have exceeded their full assimilative capacity under the current conditions assessment include:

- Beards Creek, Big Cedar Creek, Ohoopee River, and the base of the main stem of the Altamaha River in the Altamaha Basin;
- Alligator Creek, and portions of the main stem of the Ocmulgee River in the Ocmulgee Basin;
- Peterson Creek and portions of the main stem of the Oconee River in the Oconee Basin;
- Cedar Creek and Tenmile Creek in the Ogeechee Basin; and
- Alapaha River and Mill Creek in the Suwannee Basin.

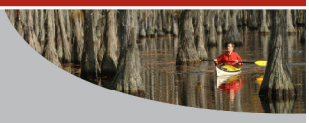
**Table 5-6: Permitted Assimilative Capacity for DO in Altamaha Planning Council**

| Basin | Available Assimilative Capacity (Total Mileage) | | | | | | Modeled Miles in Council |
|---|---|---|---|---|---|---|---|
| | Very Good (≥1.0 mg/L) | Good (0.5 to <1.0 mg/L) | Moderate (0.2 to <0.5 mg/L) | Limited (>0.0 to <0.2 mg/L) | None or Exceeded (<0.0 mg/L) | Unmodeled | |
| Altamaha | 152 | 57 | 44 | 86 | 46 | 0 | 385 |
| Ocmulgee | 120 | 81 | 54 | 22 | 29 | 0 | 306 |
| Oconee | 15 | 11 | 1 | 28 | 25 | 0 | 80 |
| Ogeechee | 19 | 69 | 65 | 15 | 10 | 4 | 182 |
| Suwannee | 0 | 1 | 0 | <1 | 9 | 0 | 11 |

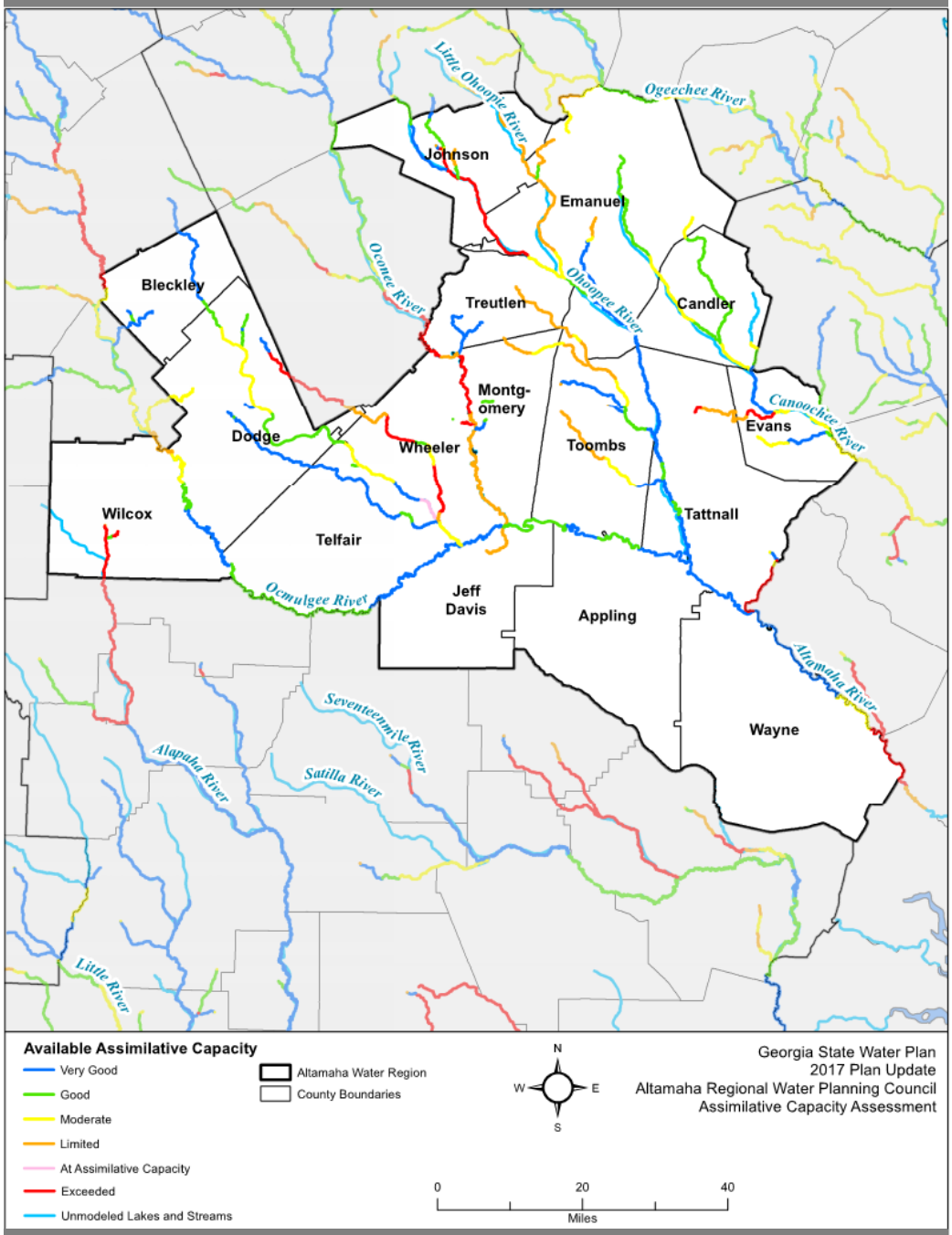
Source: GIS Files from the Updated Permitted Water Quality Resource Assessment; EPD, May 2017

Based on the results shown in Figure 5-3, EPD also conducted modeling under future conditions. In order to address areas of limited or no assimilative capacity for DO, EPD incorporated some assumptions regarding future (2050) permitted flows and modifications to permit effluent limits. Since EPD cannot issue permits that will violate water quality standards, EPD will continue to evaluate and modify future permit requests and adjust permit limits to avoid potential DO violations. Figure 5-4 shows the assimilative capacity at assumed future (2050) permitted flows and effluent limits. More information regarding the type of assumptions made under future conditions modeling is provided in the Synopsis Report – Water Quality (Assimilative Capacity) Resource Assessment (EPD, 2017).

Along the Altamaha River in Wayne County, the permitted effluent limits for one of the major wastewater discharge facilities (Rayonier Advanced Materials, Wayne County) in the region were modified under a permit issued in late 2015, and the updated limits from that permit are incorporated into the future conditions modeling. Those results indicate that there will be no exceedance of DO assimilative capacity in the Altamaha River under future conditions, as shown in Figure 5-4.

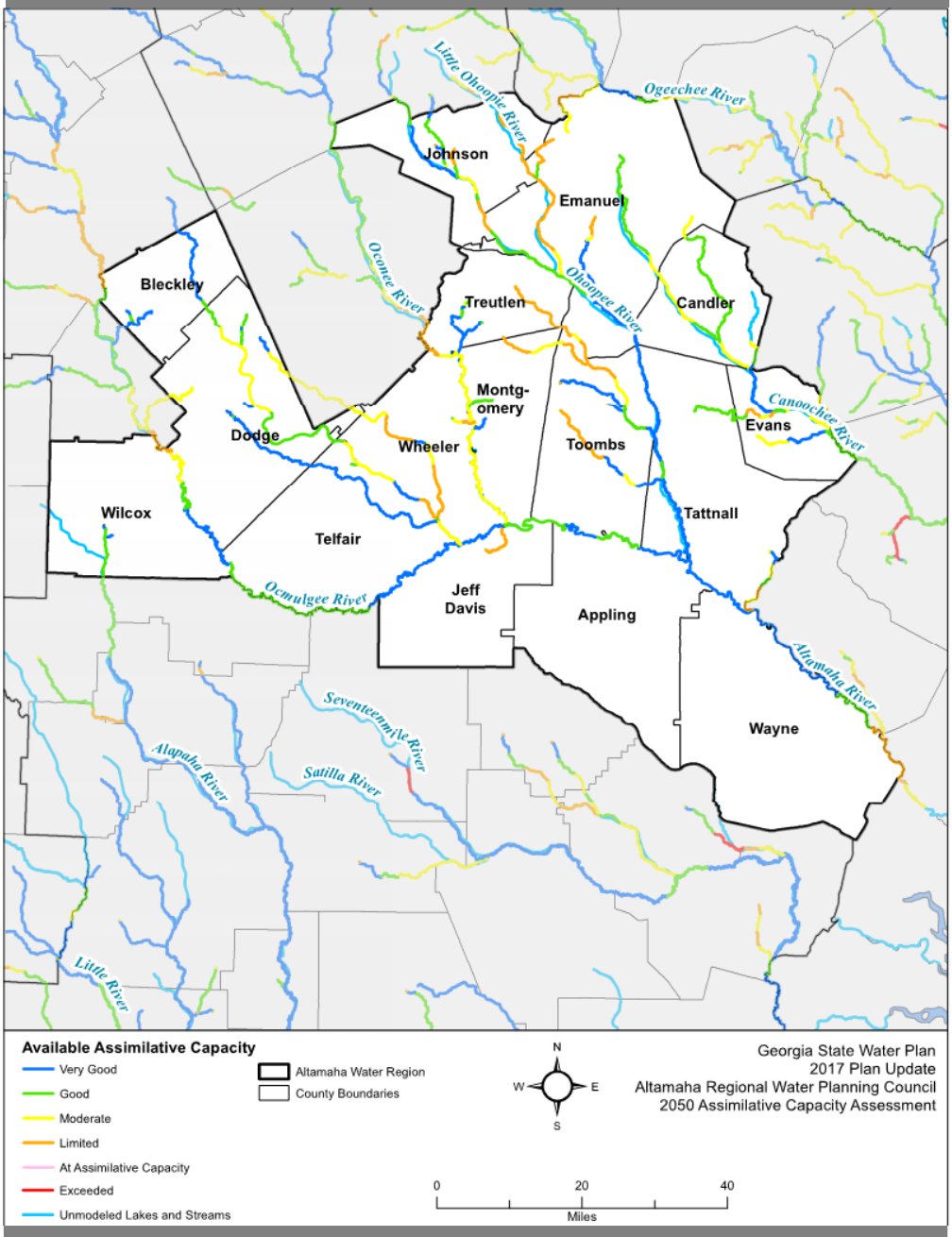


## Figure 5-3: Results of Assimilative Capacity Assessment – DO at Permitted Conditions

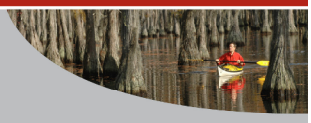



Source: Provided GIS Files from Updated Assimilative Capacity Assessment; EPD, January 2017

**Figure 5-4 Results of Assimilative Capacity Assessment – DO at Assumed Future (2050) Permitted Conditions**




**Source: Provided GIS Files from Updated Assimilative Capacity Assessment; EPD, January 2017**



### Non-Point Source Pollution

Non-point source pollution accounts for the majority of surface water impairments in the region according to the 2014 303(d) list of Rivers, Streams, Lakes, and Reservoirs published by EPD (see discussion in Section 3). Non-point source pollution can occur as a result of human activities, including urban development, agriculture, and silviculture, and as a result of non-human influences such as wildlife and naturally-occurring nutrients. An important component of any non-point source management program is identifying those pollutant sources that are resulting from human activities.

An analysis of nutrients (total nitrogen and total phosphorus) that may occur due to point sources and nonpoint sources in watersheds was conducted. The goal was to identify nutrient loading rates from different portions of the watersheds under various hydrologic conditions and evaluate them in relation to corresponding land uses and potential non-point source contributions. Results of watershed nutrient modeling identify portions of the watersheds where there are higher concentrations of nutrients (total nitrogen and total phosphorus) in stormwater runoff than other parts of the watershed.

There are currently no nutrient standards in place for the Altamaha Region, so there is no absolute threshold against which these nutrient loadings are compared. Rather, the nutrient model results are beneficial for relative comparisons to target areas where implementation of non-point source control management practices will have the greatest benefit. More detail regarding the nutrient model results is available in the Water Quality (Assimilative Capacity) Resource Assessment (EPD, 2017). Nutrient and non-point source control management practices specific to land uses within the Altamaha Region are discussed in Section 6.

## 5.4. Summary of Potential Water Resources Issues

This section summarizes the potential water resources issues in the Altamaha Region. These potential water resources issues are the basis for the recommended management practices in Section 6. Table 5-7 summarizes the potential water resource issues and permitted capacity needs in the Altamaha Region by County.

- Over the planning horizon, forecasted surface water demands within the Altamaha Region are projected to exceed the available resource in the Canoochee River. Increased demand in the region may also add to potential surface water gaps downstream of the region on the Ogeechee River at the Kings Ferry, Eden and Claxton planning nodes, the Satilla River at Atkinson node, and the Alapaha River at the Statenville node.

- At the regional level, for modeled aquifers, no groundwater resource shortfalls are expected to occur in the Altamaha Region over the planning horizon.

- Assimilative capacity assessments indicate the need for improved wastewater treatment in some facilities within the Altamaha, Ocmulgee, Ogeechee, and Suwannee river basins.

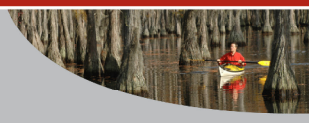
- Addressing non-point sources of pollution and existing water quality impairments will be a part of addressing the region's future needs.

**Table 5-7: Summary of Potential Water Resource Issues by County**

| County | Municipal Water Permitted Capacity Need | Part of Drainage Area with Modeled Surface Water Gaps | Municipal Wastewater Permitted Capacity Need | Water Quality – DO Assimilative Capacity Issues |
|---|---|---|---|---|
| *Source* | *Table 5-1* | *Figure 5-2* | *Table 5-5* | *Figure 5-3* |
| Appling | - | Yes | - | - |
| Bleckley | - | - | - | - |
| Candler | - | Yes | - | - |
| Dodge | - | - | - | Yes |
| Emanuel | Yes | Yes | - | Yes |
| Evans | Yes | Yes | - | - |
| Jeff Davis | Yes | Yes | - | - |
| Johnson | - | - | - | Yes |
| Montgomery | - | - | - | - |
| Tattnall | - | Yes | - | Yes |
| Telfair | - | - | - | - |
| Toombs | - | - | - | - |
| Treutlen | - | - | - | Yes |
| Wayne | - | Yes | - | Yes |
| Wheeler | Yes | - | - | Yes |
| Wilcox | - | Yes | - | - |

Notes:
1) "Yes" indicates a predicted gap in the indicated county (for surface water, "yes" indicates part or all of the indicated county lies in the area contributing to a potential gap)
2) Permitted capacity need is based on the comparison of permitted municipal capacity versus 2050 forecasted demand.

# 6. ADDRESSING WATER NEEDS AND REGIONAL GOALS



# Section 6. Addressing Water Needs and Regional Goals

This Section presents the Altamaha Council's water management practices selected to address resource shortfalls or gaps identified and described in Section 5, and/or to meet the Council's Vision and Goals described in Section 1.

**Summary**

*The Altamaha Council selected management practices to help address surface water low flow conditions at the Claxton and shared resource planning nodes, and to provide for sustainable use and development of groundwater and surface water in other areas of the region.*

*Water quality management practices focus on addressing dissolved oxygen conditions at select locations and best management practices to address non-point sources of pollution and help reduce nutrient sources.*

*Additional water and wastewater permit capacity and new/upgraded infrastructure will be needed to address existing and/or future uses.*

## 6.1. Identifying Water Management Practices

The comparison of Resource Assessments and forecasted demands presented in Section 5 identifies the Region's likely resource shortfalls or gaps and demonstrates the necessity for region and resource specific water management practices. In cases where shortfalls or gaps appear to be unlikely, the Council identified needs (e.g., facility/infrastructure needs and practices, programmatic practices, etc.) and corresponding management practices that are aligned with the Region's Vision and Goals. In selecting the actions needed (i.e., water management practices), the Council considered practices identified in existing plans, the Region's Vision and Goals, and coordinated with local governments and water providers as well as neighboring Councils that share these water resources.

### Review of Existing Plans and Practices

The Council conducted a comprehensive review of existing local and regional water management plans and relevant related documents to frame the selection of management practices. The types of plans/studies that were reviewed to support identification and selection of management practices for the Altamaha Region consisted of the following:

- Comprehensive Work Plans (local and regional scale)
- EPD databases (permitted withdrawals, planned projects, and proposed reservoirs)
- State-wide guidance documents (conservation, cost, and water planning)

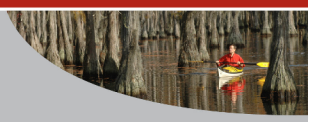
- Best Management Practices (agriculture, forestry, and stormwater management)
- Water quality studies (basin, watershed, and local scale)
- TMDL evaluations

When possible, successful management practices already planned for and/or in use in the Altamaha Region formed the basis for the water management practices selected by the Council.

## 6.2. Selected Water Management Practices for the Altamaha Region

Table 6-1 summarizes the Altamaha Council's selected management practices by source of supply for the relevant demand sector(s), including surface water supply for agricultural irrigation, permitted municipal and industrial water and wastewater capacity, water quality assimilative capacity (dissolved oxygen) challenges, current water quality impairments, and nutrient considerations for the Satilla River watershed. The table summarizes general information regarding management practices needed to meet forecasted needs, and more detailed information on management practices needed to address gaps between available resources and forecasted needs. Information on shared resources is provided at the end of the table to identify where management practices in other regional Councils are also needed to address identified gaps. The Altamaha Council reviewed a number of existing local and regional water management plans and related documents during the development and selection of management practices. A detailed list of plans and documents that were considered can be found in the Altamaha Plans Reviewed in Selecting Management Practices Technical Memorandum (CDM, 2011). The Altamaha Council reviewed the management practices to ensure they were in alignment with the region's vision and goals.

The most significant gaps in the Altamaha Region are potential surface water availability gaps driven by agricultural irrigation usage. As such, the majority of water supply management practices in Table 6-1 are intended to address agricultural surface water use (in the table the term 7Q10 refers to the 1 in 10 year 7 day low flow condition). Table 5-2 and Figure 5-3 both summarize the location and magnitude of potential regional surface water gaps and should be referenced to provide the geographic focus of the management practices. The Altamaha Council considered a number of agricultural conservation practices to address these surface water availability gaps. The Altamaha Council concluded that integrating practices, rather than using a single practice, would be more effective at addressing gaps and more economically feasible. Figure 6-1 illustrates the Altamaha Council's recommended suite of surface water availability management practices, which will be implemented via an incremental and adaptive approach. Those practices that are less costly and more readily implemented are prioritized for short-term implementation. If resource



needs are not met and/or gaps are not addressed, then more costly and complex management practices will be pursued.

Potential surface water gaps in the region exist under current and future conditions at the Claxton node, and the shared resource planning nodes outside the region (Eden, King's Ferry, Statenville, and Atkinson), and will be addressed by management practices that reduce net consumption, replace surface water use with groundwater use, and improve data on frequency and magnitude of gaps, among others. A portion of the potential gaps in the Ogeechee basin (Claxton, Eden and King's Ferry nodes) at Claxton occur primarily as a result of net consumption associated with agricultural water use in the February-November time frame; another portion of the potential gaps are associated with periods of drought. The Altamaha Council's management practices will address a significant portion of the net consumption at Claxton and when combined with management practices from the Coastal Georgia and Savannah-Upper Ogeechee water planning regions, will over time address surface water gaps at the Claxton, Eden and King's Ferry nodes. The management practices can also serve to address portions of the potential gaps at the Statenville and Atkinson nodes. Finally, as described in Section 5.2 it is important to keep in mind that potential gap conditions do not occur every year. In some cases, for years with potential gaps, the gaps do not occur for the entire year.

Figure 6-2 illustrates the Altamaha Council's recommended suite of surface water quality management practices in a phased approach. Table 6-1 also includes the Altamaha Council's recommended management practices to address water quality gaps, including stream segments with no dissolved oxygen assimilative capacity and insufficient wastewater permit capacity.

In addition to addressing gaps, the Altamaha Council identified several management practice recommendations in Table 6-1 to address forecasted future uses. These recommendations include practices such as the additional sustainable development of groundwater and surface water in areas with sufficient supply; management of other water quality issues such as non-point source runoff, nutrient loadings, TMDLs in the region; and additional educational and ordinance practices. The selected management practices will over time address identified gaps and meet future uses when combined with practices for all shared resource regions.

**Figure 6-1: Recommended Surface Water Availability Management Practices in a Phased Approach**

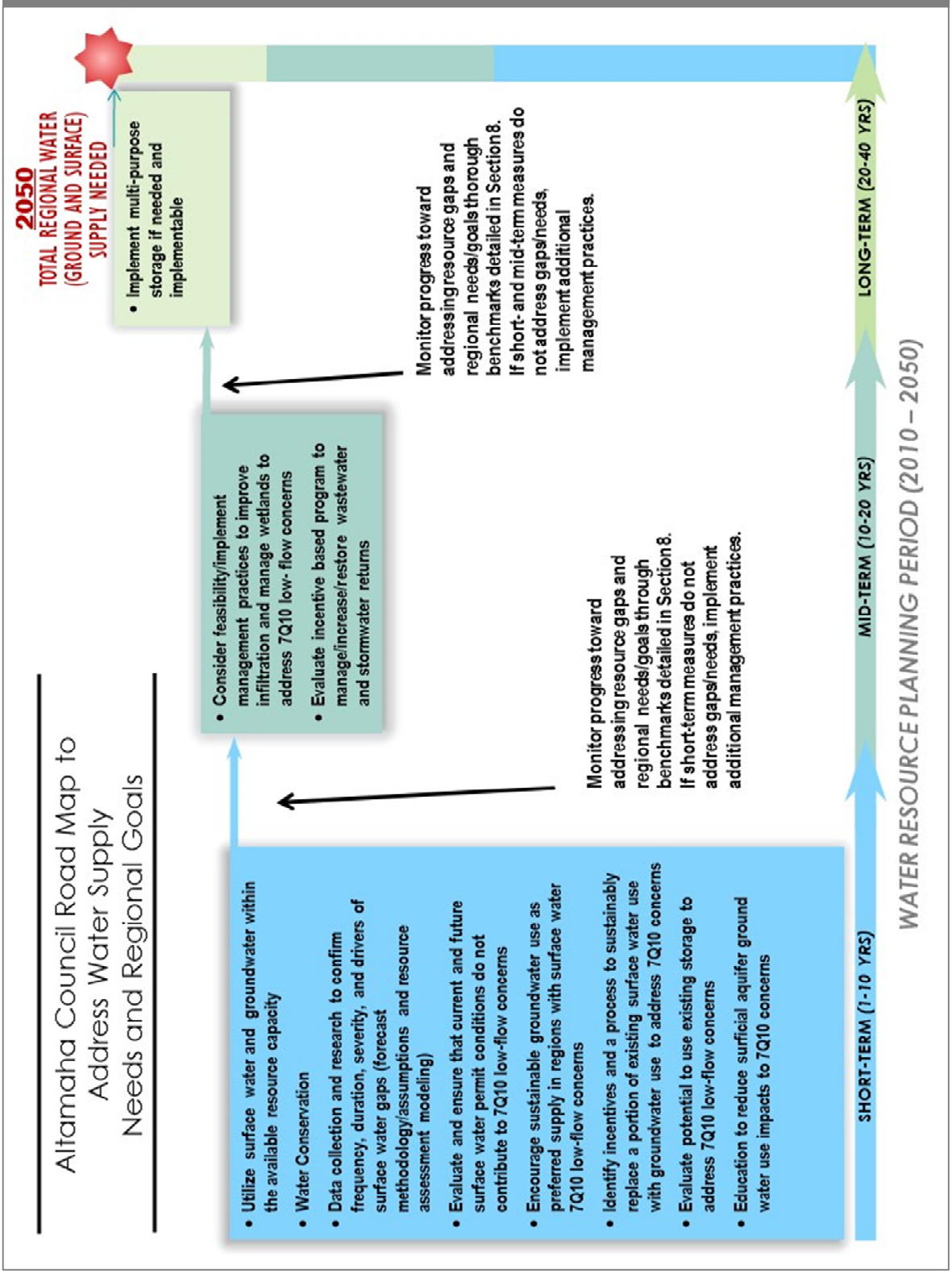
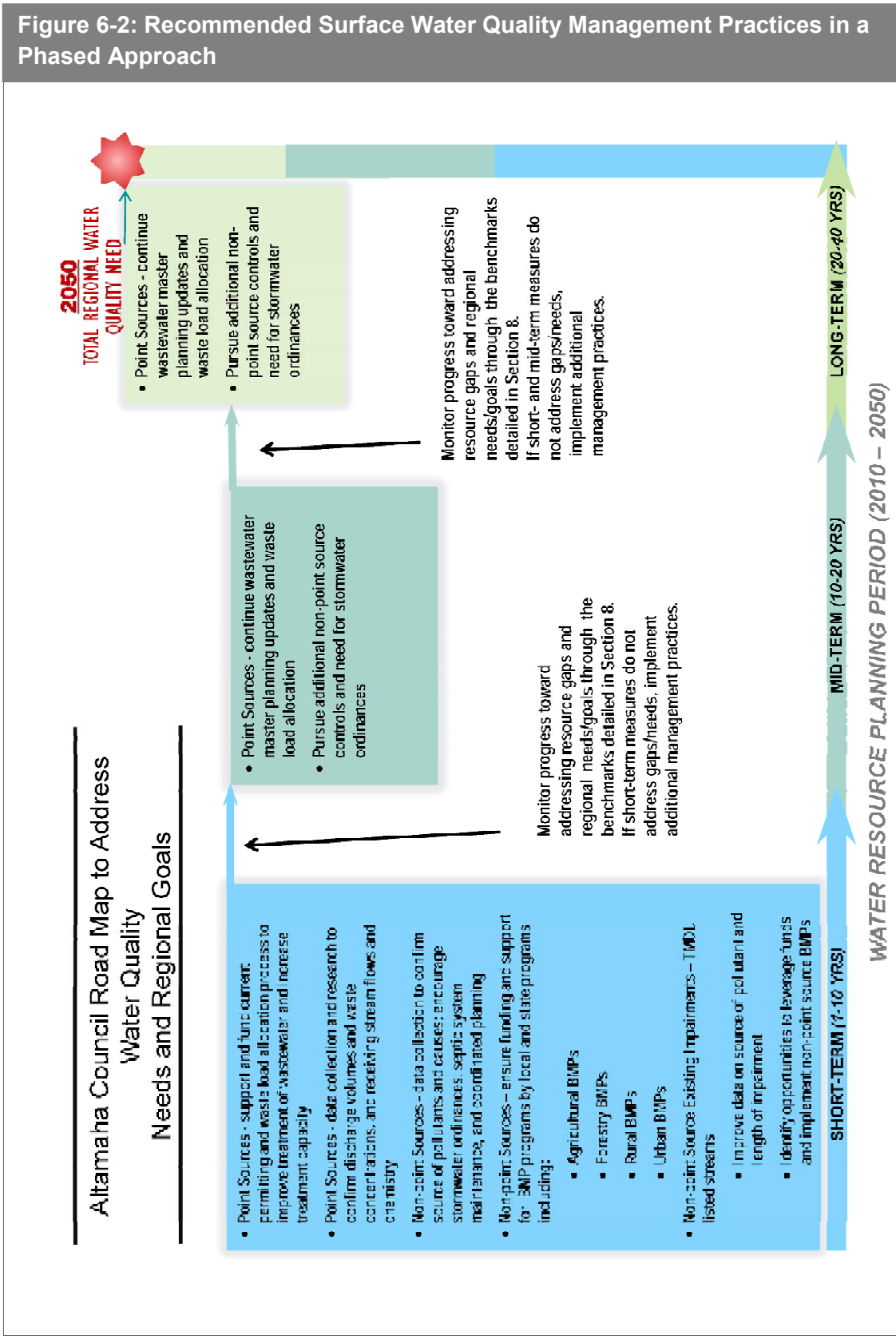


**Figure 6-2: Recommended Surface Water Quality Management Practices in a Phased Approach**



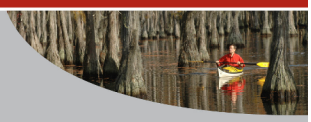
| Table 6-1: Management Practices Selected for the Altamaha Region | | | |
|---|---|---|---|
| **Management Practice Number** | **Issue(s) to be Addressed by Action(s)** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| **Action Needed - Address Current and Future Surface Water Use in Gap Areas**<br>**Data Collection/Additional Research (DCAR)** to confirm frequency, duration, severity, and drivers of surface water gaps and identify significant causes (climate, timing, water use, land cover, etc.) of 7Q10 low flow conditions and advance research/feasibility of potential solutions | | | |
| DCAR-1 Agricultural Consumption Data | Improve understanding and quantification of agricultural water use and the projected surface water gaps on the Canoochee River at Claxton, Ogeechee River at Kings Ferry, Alapaha River at Statenville, Satilla River at Atkinson (hereafter referred to as "gap areas") | -Acquire additional data/information on agricultural consumptive use to confirm or refine if agricultural consumption is less than 100% consumptive[1]<br>-Conduct "modeling scenario analysis to bracket a reasonable range of consumption" with Resource Assessment models with "new" information on consumptive use to assess effect on surface water gap[1] | 2,6 |
| DCAR-2 Source of Supply Data to Refine Forecasts | | Refine surface water agricultural forecasts and Resource Assessment models to improve data on source of supply and timing/operation of farm ponds and dual source irrigation systems[1] | 2,6 |
| DCAR-3 Metering Data | Obtain additional data and improved understanding of actual versus forecasted water use | -Continue to fund, improve, and incorporate agricultural water use metering data; collect and use this information in Water Plan updates.<br>-Expand number of GSWCC continuously monitored real-time meter sites in surface water gap areas.[1]<br>-Maintain and fund river gauging stations. | 2,3,6 |
| DCAR-4 Support Irrigation Efficiency Research | Improvement of surface water flows (in gap areas) via reduced surface water use while maintaining/ improving crop yields | Support research (University, State, and Corporate) on improved irrigation efficiency measures and development of lower water use crops and plant strains[1] | 2,3,6 |
| DCAR-5 Irrigation Education and Research | | Improve education and research on when and how much water is needed to maximize crop yield with efficient irrigation[1] | 2,3 |

| Table 6-1: Management Practices Selected for the Altamaha Region | | | |
|---|---|---|---|
| **Management Practice Number** | **Issue(s) to be Addressed by Action(s)** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| DCAR-6 Minimize Groundwater Use Impacts on Surface Water | Improvement of surface water flows (in gap areas) where groundwater and surface water are hydrologically connected and groundwater use impacts surface water flows | Promote management practices and educate water users to minimize impacts to surface water associated with excessive pumping/use of shallow/ surficial aquifers that may impact surface water flows | 2,3,6,9 |
| DCAR-7 Address Low Flow with Wetland Restoration and Retention Structures | Examine potential role of wetlands restoration and water retention structures in addressing surface water low flow conditions. Evaluate implementation considerations for each option. | Develop plan of study and conduct research to evaluate the opportunities and limitations associated with improving river flow conditions via creation/restoration of wetlands systems and potential water retention structures including streams, and if deemed potentially feasible, identify potential location(s) and estimates of potential improvements to stream flow conditions. This effort should include the identification of the incentives that could be used to make this a viable water supply option and a cost-benefit analysis of these incentives. | 2,6,9,11 |
| DCAR-8 Analyze Addressing Extreme Conditions | Cost effectively address surface water low flow conditions (in gap areas) while avoiding undue adverse impacts on water users and uses in the planning area | Conduct analysis of the socioeconomic benefits and cost in comparison to ecological benefits of addressing surface water gaps. Council discussion, and additional detail provided by EPD during the 2016-17 updates to the resource assessments, indicated the need to focus this Management Practice on the more frequent, smaller magnitude gaps, rather than the larger, longer duration gaps that would likely be addressed through drought management measures. Additional analysis is also needed (similar to the examples shared during the surface water shared resources subcommittee meeting in January 2017) regarding the locations of demands contributing to the gaps within specific counties and portions of the local drainage areas (LDAs). | 2,5,6,11 |

| Table 6-1: Management Practices Selected for the Altamaha Region | | | |
|---|---|---|---|
| **Management Practice Number** | **Issue(s) to be Addressed by Action(s)** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| **Action Needed - Water Conservation (WC)** - Address current and future gaps and meet water needs by efficient water use. The Altamaha Council supports the 25 water conservation goals contained in the March 2010 Water Conservation Implementation Plan (WCIP). | | | |
| WC-1 Tier 1 and Tier 2 Measures for Municipal and Industrial Users | Help meet current and forecasted municipal and industrial surface water and groundwater supply needs throughout the region | Municipal and Industrial water uses - encourage implementation and adherence to Tier 1 and Tier 2 water conservation measures established in existing and future rulemaking processes and plans [WCIP, Coastal Permitting Plan (including applicable Tier 3 and Tier 4 practices), Water Stewardship Act of 2010 and EPD rules for public water systems to improve water supply efficiency through water loss audit and water loss control programs (391-3-33)] by local governments/utilities | 3 |
| WC-2 Tier 1 and Tier 2 Measures for Agriculture | Help meet current and forecasted agricultural surface water and groundwater supply needs throughout the region | Encourage implementation of Tier 1 and Tier 2 conservation measures and adherence to WCIP by agricultural groundwater users | 3 |
| **Action Needed - Water Conservation (WC)** - Meet current and future gaps and needs by efficient agricultural water use - Tier 3 Conservation Practices[1] | | | |
| WC-3 Audits | - Help meet current and forecasted agricultural ground and surface water supply needs<br>- Help address surface water gap areas | Conduct irrigation audits | 3 |
| WC-4 Metering | | Meter irrigation systems | |
| WC-5 Inspections | | Inspect pipes and plumbing to control water loss | |
| WC-6 Minimize High-Pressure Systems | | Minimize or eliminate the use of high-pressure spray guns on fixed and traveler systems where feasible | |

| Table 6-1: Management Practices Selected for the Altamaha Region | | | |
|---|---|---|---|
| **Management Practice Number** | **Issue(s) to be Addressed by Action(s)** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| WC-7 Efficient Planting Methods | | Utilize cropping and crop rotation methods that promote efficiency | |
| **Action Needed - Water Conservation (WC) Continued** - Meet current and future gaps and needs by efficient water use - Tier 4 Conservation Practices[1] | | | |
| WC-8 Conservation Tillage | - Help meet current and forecasted agricultural ground and surface water supply needs<br>- Help address surface water gap areas | Practice conservation tillage | 3 |
| WC-9 Control Loss | | Control water loss | |
| WC-10 End-Gun Shutoffs | | Install end-gun shutoff with pivots | |
| WC-11 Low Pressure Systems | | Install low pressure irrigation systems where feasible (soil specific) | |
| WC-12 Application Efficiency Technologies | | Encourage and improve use of soil moisture sensors, ET sensors, or crop water use model(s) to time cycles | |
| **Additional/Alternate to Existing Surface Water Supply Sources (ASWS)**[1] High Priority Management Practices | | | |
| ASWS-1 Incentives for Sustainable Groundwater Development | Help improve surface water flow in gap areas during low flow conditions | Future and existing agricultural surface water uses - Using collaboration and incentive based program(s), encourage additional groundwater development as preferred source of supply for future demand where feasible and within the estimated sustainable yield of the resource. Identify the need for, and feasibility of, incentive-based seasonal surface water permit conditions to address 7Q10 low flow conditions. | 2,4,6,9 |
| ASWS-2 Land Management Incentives | | Incentive-based land use practices to help promote infiltration and aquifer recharge | 1,9,12 |

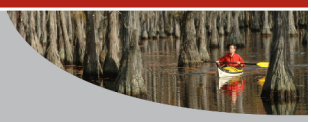
| Table 6-1: Management Practices Selected for the Altamaha Region | | | |
|---|---|---|---|
| **Management Practice Number** | **Issue(s) to be Addressed by Action(s)** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| ASWS-3 Incentives for Greater Wastewater Returns | | Identify incentive-based programs to increase wastewater returns; modify/manage land application systems, septic systems, and stormwater returns to address 7Q10 low flow conditions | 2,6,10,11 |
| **Additional/Alternate to Existing Surface Water Supply Sources (ASWS)**[1] Medium Priority Management Practices | | | |
| ASWS-4 Monitor Gap Closure and Manage Adaptively | Help improve surface water flow in gap areas during low flow conditions | Monitor gap closure. If progress toward gap closure is not achieved, evaluate need and feasibility to conjunctively manage groundwater and surface water to address surface water flow shortages during 7Q10 low flow conditions | 2,4,6,9 |
| ASWS-5 Restoration Incentive Programs | | Based on outcome of research (DCAR-7 above), consider incentive-based programs to restore wetlands and other areas if this practice can improve river flows during shortages to 7Q10 dry periods without impairing timber harvesting opportunities | 2,6,7,9,11 |
| **Additional/Alternate to Existing Surface Water Supply Sources (ASWS)**[1] Low Priority Management Practices | | | |
| ASWS-6 Consider Low Flow Conditions in Future Surface Water Permitting | Help ensure that future surface water use does not contribute to frequency and severity of low flow conditions within the Local Drainage Areas that contribute flow to gap areas | Future surface water uses - If surface water (ponds and withdrawals) is sought for future water supply in gap areas (new permits), the Applicant and EPD should work collaboratively to promote surface water use patterns that will not significantly contribute to frequency or magnitude of 7Q10 low flow conditions | 2,6,9 |
| ASWS-7 Incentives for Dry-Year Releases from Ponds | Help improve surface water flow in gap areas during low flow conditions | Future and existing surface water uses - Utilizing incentives and collaborative partnerships, examine opportunities to modify farm and other pond operations to obtain releases in dry/gap years | 2,4,6 |



| Table 6-1: Management Practices Selected for the Altamaha Region | | | |
|---|---|---|---|
| **Management Practice Number** | **Issue(s) to be Addressed by Action(s)** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| **Action Needed - Address Water Quality (Dissolved Oxygen Levels)** | | | |
| **Point Sources – Dissolved Oxygen (PSDO)** | | | |
| PSDO-1 Collect Water Quality Data | Verification of Water Quality Resource Assessment Data and Assumptions to determine dissolved oxygen conditions (see Figure 5-2 for more information) | Data collection to confirm loading and/or receiving stream chemistry | 2,6,9 |
| PSDO-2 Point Discharge Relocation | Improve dissolved oxygen levels in receiving streams (see Figure 5-2 for more information) | Modification of wastewater discharge location. In areas with shortages to 7Q10 low flow conditions, identify feasibility to move discharge location to higher flow streams with greater assimilative capacity. | 9-11 |
| PSDO-3 Enhance Point Source Treatment | | Upgrade/improve treatment to address low dissolved oxygen conditions in receiving streams | 2,6,9-11 |
| **Available Industrial Wastewater Permit Capacity (IWWPC)** | | | |
| IWWPC-1 Collect Additional Industrial Permit Data | Collect additional data where needed on industrial flow volumes and permit conditions to verify permitted versus forecasted needs | Obtain additional permit data regarding flow volumes and permit conditions for industrial wastewater facilities forecasted needs[2] | 9-11 |
| **Action Needed - Address Water Withdrawal Permit Capacity Needs** | | | |
| **Municipal Groundwater Permit Capacity (MGWPC)** | | | |
| MGWPC-1 Increase Municipal Groundwater Permit Capacity | Additional municipal groundwater permit capacity may be needed in Emanuel, Evans, Jeff Davis, Wheeler, and Wilcox Counties | Obtain groundwater permit capacity and construct new or expanded facilities to meet forecasted need | 6,9,11 |

| Table 6-1: Management Practices Selected for the Altamaha Region | | | |
|---|---|---|---|
| **Management Practice Number** | **Issue(s) to be Addressed by Action(s)** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| **Industrial Groundwater Permit Capacity (IGWPC)[2]** | | | |
| IGWPC-1 Increase Industrial Groundwater Permit Capacity | Additional industrial groundwater permit capacity may be needed in Evans and Wayne Counties | Obtain groundwater permit capacity and construct new or expanded facilities to meet forecasted need | 6,9,11 |

| Table 6-1: Management Practices Selected for the Altamaha Region | | |
|---|---|---|
| **Management Practice Number** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| **The following Altamaha Council Management Practices are programmatic in nature and are therefore described in general terms.** | | |
| **Action Needed - Address Current and Future Groundwater (GW) Needs** | | |
| GW-1 Sustainable Groundwater Use | Continue to sustainably drill wells and withdraw groundwater from the Floridan and other prioritized aquifers and use of other aquifer systems in the region to meet regional needs | 2,6,9 |
| GW-2 Research Groundwater Sustainability | Continue to refine sustainable yield metrics, monitor and improve understanding of historic, current, and future trends in groundwater levels<br><br>Use best available science when evaluating potential value and/or impact associated with aquifer storage and/or recovery of surface water | 2,4,6 |
| GW-3 Promote Aquifer-Friendly Land Use | Encourage land use practices that sustain and protect aquifer recharge areas (both inside and outside the region) for the aquifers that are present in the region | 1 |
| **Management Practices to Address Current and Future Surface Water (SW) Needs** | | |
| SW-1 Maintain Current Permitted Capacity | Continue to apply for permits and use surface water within the available surface water resource capacity | 2,6,9 |

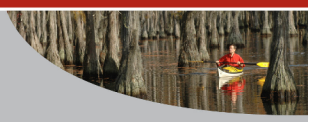


| Table 6-1: Management Practices Selected for the Altamaha Region | | |
|---|---|---|
| **Management Practice Number** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| SW-2 Monitor and Evaluate Estuaries | Monitor Atlantic slope river flow conditions to help determine flow conditions that sustain estuary conditions | 9,11 |
| **Management Practices to Address Water Quality Non-Point Source (NPS) Needs** | | |
| **(Dissolved oxygen, fecal coliform, nutrients, and other impairments)** | | |
| NPS-1 Study Human Impacts on Water Quality | Data collection/analysis to confirm if dissolved oxygen and/or fecal coliform is human induced | 9-11 |
| NPS-2 Research and Address Impairment Issues | Collect data to determine the sources of nutrient loading and other NPS impairments to waters of the State, and upon confirmation of source, develop specific management programs to address | 9-11 |
| ***The following practices are selected by the Altamaha Council to encourage implementation by the applicable local or state program(s).*** | | |
| **Urban Best Management Practices (NPSU)** | | |
| NPSU-1 Control Erosion | Use soil erosion and sediment control measures | 9,11 |
| NPSU-2 Manage Stormwater Runoff | Stormwater retention ponds, wetlands to manage runoff and help support river flows | 9,11 |
| NPSU-3 Increase Stormwater Infiltration | Promote measures to increase infiltration of stormwater to help reduce nutrient and other pollutant runoff (City of Baxley Watershed Protection Plan, 2007) | 1,9,11 |
| NPSU-4 Riparian Buffers | Protect and maintain riparian buffers along urban streams | 9,11 |
| NPSU-5 Street Sweeping | Implement street sweeping program (City of Baxley Watershed Protection Plan, 2007) | 9,11 |

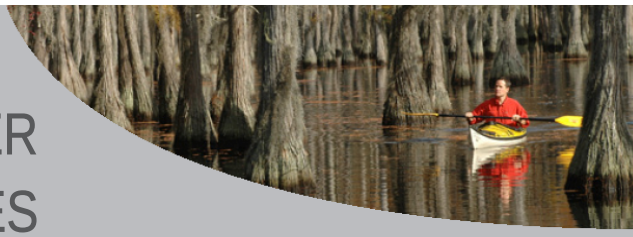
| Table 6-1: Management Practices Selected for the Altamaha Region | | |
|---|---|---|
| **Management Practice Number** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| **Rural Best Management Practices (NPSR)** | | |
| NPSR-1 Advocate Implementing Road Runoff BMPs | Implement BMPs to control runoff from dirt roads by encouraging County implementation of the BMPs identified in Georgia Resource Conservation and Development Council, "Georgia Better Back Roads – Field Manual" | 9,11 |
| **Forestry Best Management Practices (NPSF)** | | |
| NPSF-1 Support Forestry Commission Water Quality Program | Support Georgia Forestry Commission water quality program consisting of BMP development, education/outreach, implementation/compliance monitoring, and complaint resolution process | 9,11 |
| NPSF-2 Improve BMP Compliance | Improve BMP compliance through State-wide biennial BMP surveys and BMP assurance exams, Master Timber Harvester workshops, and continuing logger education | 9,11 |
| NPSF-3 Wetland and Forest Restoration Incentives | Incentives to restore wetlands and historically drained hardwood and other areas. Where applicable, support United States Department of Agriculture (USDA) incentive programs through the Farm Service Agency and NRCS to restore converted wetlands back to forested conditions. | 9,11 |
| **Agricultural Best Management Practices for Crop and Pasture Lands (NPSA)** - Support and encourage implementation of GSWCC BMP and Education Programs | | |
| NPSA-1 Soil Erosion Reduction Measures | Conservation tillage and cover crop | 3,9 |
| NPSA-2 Utilize Buffers | Field buffers, riparian forested buffers, and strip cropping to control runoff and reduce erosion | 3,9,11 |
| NPSA-3 Livestock Management | Livestock stock exclusions from direct contact with streams and rivers and vegetation buffers | 9,11 |
| NPSA-4 Manure Control | Responsible manure storage and handling | 9,11 |

| Table 6-1: Management Practices Selected for the Altamaha Region | | |
|---|---|---|
| **Management Practice Number** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| NPSA-5 Wetland and Forest Restoration Incentives | Incentives to restore wetlands and historically drained hardwood and other areas | 9,11 |
| **Existing Impairments and Total Maximum Daily Load Listed Streams (TMDL)** | | |
| TMDL-1 Evaluate Impairment Sources | Data collection and confirmation of sources to remove streams listed due to "natural sources" | 8,9 |
| TMDL-2 Analyze Impaired Segments and Sources | Data collection to refine river/stream reach length for impaired waters; focus on longest reaches to refine location and potential sources of impairments | 8,9 |
| TMDL-3 Stormwater Management BMPs | Stormwater Management:<br>- Agricultural BMPs<br>- Forestry BMPs<br>- Rural BMPs<br>- Urban BMPs<br>See Above Non-Point Source for Details | 9,11 |
| **Nutrients – Regional Watershed Models (NUT)** | | |
| NUT-1 Link Nutrient Loading With Current Land Use | Align current land use with phosphorus and nitrogen loading data to help optimize effectiveness of management practice based on consideration of land uses and actual nutrient loading contribution to surface water resources (i.e., predominant land use is not necessarily the predominant source of nutrient) within all watersheds that affect the Altamaha Region<br>- Agricultural BMPs<br>- Forestry BMPs<br>- Rural BMPs<br>- Urban BMPs<br>See Above Non-Point Source for Details | 9,11 |
| **Management Practices to Address Future Educational Needs (EDU)** | | |
| EDU-1 Promote Conservation Programs | Support Water Conservation Programs | 2,3,5,6 |

| Table 6-1: Management Practices Selected for the Altamaha Region | | |
|---|---|---|
| **Management Practice Number** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| EDU-2 Stormwater Education | Support Stormwater Educational Programs | 9,11 |
| EDU-3 Septic System Maintenance Education | Support Septic System Maintenance Programs | 9,11 |
| EDU-4 Forestry BMP Education | Support Georgia Forestry Commission Forestry BMP and UGA-SFI Logger Education Programs | 9,11 |
| EDU-5 Clean-Up Events | Conduct stream clean-up events (Examples include the Lumber City Watershed Protection Plan, 2007, City of Eastman, Wayne County) | 9,11 |
| **Management Practices to Address Future Ordinance and Code Policy Needs (OCP)** | | |
| OCP-1 Engage Local Governments | Encourage local government to adopt tools and practices to implement and/or update stormwater and land development strategies to improve water quality/quantity. Possible resource documents include: Georgia Stormwater Management Manual, Coastal Stormwater Supplement, Metro North Georgia Water Planning District Model Ordinances, and Lumber City Watershed Protection Plan (2007) | 9,11 |
| OCP-2 Green Space Opportunities and Incentives | Identify opportunities for green space on incentive and voluntary basis | 1,7,11 |
| OCP-3 Promote Integrated Planning | Encourage coordinated environmental planning, land use, stormwater, and wastewater | 1-3,5,6,9-12 |



| Table 6-1: Management Practices Selected for the Altamaha Region | | |
|---|---|---|
| **Management Practice Number** | **Description/Definition of Action** | **Relationship of Action or Issue to Vision and Goals (Section 1.4)** |
| **Summary of Management Practices for Shared Resources –** The Altamaha Region will combine its management practices with the following Councils to address shared resource gaps. | | |
| **Surface Water Quantity – Canoochee River (Claxton), Ogeechee River (Kings Ferry), Satilla River (Atkinson), and Alapaha River (Statenville)**<br>Altamaha – The Altamaha Regional Council has identified the management practices in the above table to address the majority of the gap at Claxton, a portion of the cumulative gap at Eden and Kings Ferry, a small portion of the cumulative gap at Statenville, and a portion of the cumulative gap at Atkinson.<br>Coastal Georgia – The Coastal Georgia Regional Council has identified water conservation, replacement of surface water use with groundwater, refinement of forecasting and modeling data, and potential use of incentives and new permit conditions to address a small portion of the cumulative gap at Kings Ferry. The management practices that address potential gaps at Kings Ferry will also address the potential gaps at Claxton and Eden.<br>Savannah-Upper Ogeechee – The Savannah-Upper Ogeechee Regional Council has identified water conservation, replacement of surface water use with groundwater use, and agricultural water use monitoring program to address a portion of the cumulative gap at Kings Ferry.<br>Upper Oconee – The Upper Oconee Regional Council has identified the use of variable rate irrigation, development of new groundwater wells, and encouraging centralized sewer in developing areas to address a small portion of the gap at Eden and a small portion of the cumulative gap at Kings Ferry.<br>Suwannee-Satilla– The Suwannee-Satilla Regional Council has identified water conservation, replacement of surface water use with groundwater use, refinement of forecasting and modeling data, and potential use of incentives and new permit conditions to address the majority of the cumulative gap at Statenville and at Atkinson.<br>Upper Flint – The Upper Flint Regional Council has identified conservation, investigation of replacement of surface water with groundwater, greater utilization of farm ponds, and consideration of new storage to address a portion of the cumulative gap at Statenville.<br>**Surface Water Quality:**<br>Regional Watershed Models – The Suwannee-Satilla Regional Council has identified the same Best Management Practices for reducing nutrient loading as are summarized in the above table for the Altamaha Council.<br>Suwannee-Satilla – One reach with exceeded dissolved oxygen assimilative capacity in the Suwannee River basin is shared with the Suwannee-Satilla Region. Both regions recommend improved level of wastewater treatment to improve instream dissolved oxygen, implementation of ammonia limits, and improved treatment for nutrients (Nitrogen and Phosphorus). | | |
| Notes:<br>[1]Seek to reduce frequency and severity of human impacts to 7Q10 low flow conditions in the region, which are associated with agricultural water use in portions of the Altamaha Region. Focus on surface water permit holders and new surface water permit requests in Canoochee Watershed [Candler, Evans, Emanuel, Tattnall, and Bulloch Counties (Claxton Gap)], Ogeechee Watershed [Candler, Emmanuel, Evans and Tatnall Counties (Eden and Kings Ferry Gap)], Alapaha Watershed [Wilcox County (Statenville Gap)], and Satilla Watershed [Appling, Jeff Davis, and Wayne Counties (Atkinson Gap)].<br>[2]Additional industrial wastewater capacity may be needed. EPD to update and refine discharge limit databases. | | |



# 7. IMPLEMENTING WATER MANAGEMENT PRACTICES

# Section 7. Implementing Water Management Practices

**Summary**

*Implementation of the Altamaha Regional Water Plan will be primarily by various water users and wastewater utilities in the region. The most cost effective and more readily implemented management practices will be prioritized for short-term implementation via an incremental and adaptive approach. If resource needs are not met and/or gaps are not closed, then more costly and complex management practices will be pursued.*

*As new information becomes available, it is important the Plan remain a living document and be updated to incorporate new findings.*

This section presents the Altamaha Council's estimated time frames for the implementation of the water management practices identified in Section 6. Schedules for implementation, in addition to the early step(s) required to initiate implementation of a given practice, are presented for both short- and long-term actions. The Altamaha Council has defined short-term as years 2015 to 2025 and long-term as 2025 to 2050. As the State Water Plan provides, this Plan will be primarily implemented by the various water users in the region; therefore, the Altamaha Council has described the roles and responsibilities of the implementing parties as well as the fiscal implications of the practices.

The Altamaha Council also emphasizes that the implementation of recommended management practices are predicated on a number of planning assumptions and/or may be impacted by unanticipated or currently unknown factors including: projected growth of population, industry, agricultural and energy needs; shared resources with surrounding regions; future identification/proposal of a significant upstream water resource project; data sets and assumptions related to water use, water withdrawals and returns; data regarding water quality and watershed models; rules and regulations regarding water resource use and management; and Resource Assessment tools for surface water availability, surface water quality and groundwater availability. Consequently, significant changes or departures from these planning assumptions, forecasts, and Resource Assessment tools may require a modification of the recommended management practices, the implementation schedule, and/or the implementing entities/affected stakeholders. Future planning efforts should confirm current assumptions and make necessary revisions and/or improvements to the conclusions reached during this round of planning.

## 7.1. Implementation Schedule and Roles of Responsible Parties

Table 7-1 ties the resource shortfalls and the needs specified by the Council and the corresponding management practices detailed in Table 6-1 to the parties who will implement those practices. This table also describes the time frame for implementation and the specific steps required for implementation.

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): Further Action to Complete Implementation and Associated Dates | Responsible Parties |
|---|---|---|---|---|---|---|
| **Data Collection/Additional Research (DCAR)** | | | | | | |
| DCAR-1 through DCAR-5[1] Agricultural Data Collection and Irrigation Research | Current and Future Surface Water Use in Gap Areas (Canoochee, Ogeechee, Satilla, and Alapaha Rivers) | N/A | Develop scope of work ( and key partnering agencies | Complete data collection, research, and evaluation by 01/2020<br><br>Incorporate data/findings in next Regional Water Plan revision | N/A | EPD, Georgia Soil and Water Conservation Commission (GSWCC), Universities, Georgia Department of Agriculture (DOA) |
| DCAR-6 Minimize Groundwater Use Impacts on Surface Water | | | | | | EPD, GSWCC, and Georgia DOA |
| DCAR-7 Address Low Flow with Wetland Restoration and Retention Structures | Current and Future Surface Water Use in Gap Areas (Canoochee, Ogeechee, Satilla, and Alapaha Rivers) | N/A | Develop scope of work and key partnering agencies | Complete data collection, research, and evaluation by 01/2020<br><br>Incorporate data/findings in next Regional Water Plan revision | N/A | EPD and other research agencies/entities<br><br>USDA and other agencies for funding and incentives |

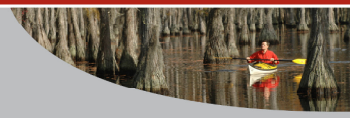


**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): | For Long-term Actions (2025-2050): | Responsible Parties |
|---|---|---|---|---|---|---|
| | | | | Further Action to Complete Implementation and Associated Dates | | |
| DCAR-8 Analyze Addressing Extreme Conditions | | | | | | EPD |
| **Water Conservation (WC)[1]** | | | | | | |
| WC-1 Tier 1 and Tier 2 Measures for Municipal and Industrial Users | Current and Future Surface and Groundwater Supply Needs | Agricultural Groundwater and Surface Withdrawal | Confirm and verify status of selected practices<br><br>Conduct outreach/ education/incentives to encourage implementation of conservation measures | Continue to implement water conservation practices through 01/2025 | Verify conservation savings estimates | EPD, Georgia Municipal Association, Georgia Association of County Commissioners, and Water Providers in the Altamaha Region |

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): Further Action to Complete Implementation and Associated Dates | Responsible Parties |
|---|---|---|---|---|---|---|
| WC-2 through WC-12 Tier 1 through Tier 4 Measures for Agricultural Users | Current and Future Surface and Groundwater Use in Gap/Non-gap Areas | Agricultural Groundwater and Surface Withdrawal | Confirm and verify status of selected practices<br><br>Conduct outreach/ education/incentives to encourage implementation of conservation measures | Continue to implement water conservation practices through 01/2025 | Verify conservation savings estimates | EPD, GSWCC, and Georgia DOA<br><br>Agricultural surface water users in the Altamaha Region for implementation |
| **Additional/Alternatives to Existing Surface Water Supply Sources (ASWS)**[1] High Priority | | | | | | |
| ASWS-1 Incentives for Sustainable Groundwater Development | Current and Future Surface Water Use in Gap Areas | Agricultural Surface/ Groundwater Withdrawal | Develop strategy and work with potential participants/ impacted users to increase support for and implementation of strategy | Encourage groundwater development as preferred source of supply<br><br>Identify the need for, and feasibility of, incentive based seasonal surface water permit conditions to address 7Q10 low flow conditions (by 01/2020) | N/A | EPD, GSWCC, Georgia DOA , and Agricultural surface water users in the Altamaha Region for implementation |

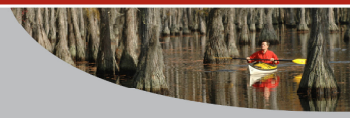


**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): Further Action to Complete Implementation and Associated Dates | Responsible Parties |
|---|---|---|---|---|---|---|
| ASWS-2 Land Management Incentives | Current and Future Surface Water Use in Gap Areas | City and County Land Use | Incentive-based practices to promote infiltration and aquifer recharge | Determine effectiveness and feasibility of implementing practice (by 01/2020) | If deemed effective and feasible, implement practice based on status of gap closure (by 01/2030) | EPD, Municipalities and Water/ Wastewater Utilities in the Altamaha Region |
| ASWS-3 Incentives for Greater Wastewater Returns | Wastewater/ Stormwater NPDES Discharge, Sanitary Sewer Extension | N/A | | Continue to monitor land use and hydrologic relationships | Wastewater/ Stormwater NPDES Discharge, Sanitary Sewer Extension | |
| **Additional/Alternatives to Existing Surface Water Supply Sources (ASWS)**[1] Medium Priority | | | | | | |
| ASWS-4 Monitor Gap Closure and Manage Adaptively | Current and Future Surface Water Use in Gap Areas | Agricultural Surface/ Groundwater Withdrawal | Develop strategy and work with potential participants/ impacted users to increase support for and implementation of strategy | Evaluate need and feasibility to conjunctively manage groundwater and surface water to address 7Q10 low flow conditions (by 01/2020) | N/A | EPD and Agricultural surface water users in the Altamaha Region for implementation |

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): Further Action to Complete Implementation and Associated Dates | Responsible Parties |
|---|---|---|---|---|---|---|
| ASWS-5 Restoration Incentive Programs | Current and Future Surface Water Use in Gap Areas | Wetland Restoration | Encourage research to determine effectiveness and feasibility of restoring wetlands (see DCAR-7) | Determine effectiveness and feasibility of restoring wetlands (by 01/2020) | Restore wetland characteristics (by 01/2030), if deemed effective and feasible | EPD |
| **Additional/Alternatives to Existing Surface Water Supply Sources (ASWS)**[1] Low Priority | | | | | | |
| ASWS-6 Consider Low-Flow Conditions in Future Surface Water Permitting | Future Surface Water Use in Gap Areas | Agricultural Surface Withdrawal | EPD to develop Data Needs and Guidance for Analysis Requirements<br><br>Applicants to submit analysis from 2015-2020 | N/A | GSWCC to collaborate with EPD, Georgia DOA, and current/future surface water users to develop application process and data needs to streamline application and review process (by 01/2025) | EPD, GSWCC, Georgia DOA, and Agricultural surface water users in the Altamaha Region for implementation |

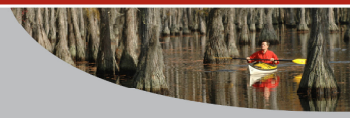
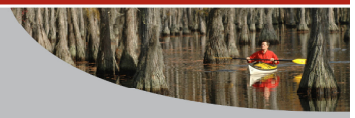


**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): | For Long-term Actions (2025-2050): | Responsible Parties |
|---|---|---|---|---|---|---|
| | | | | Further Action to Complete Implementation and Associated Dates | | |
| | | | | | Determine if expedited or revised permitting process is warranted to allow for use of the resource and protection of critical low flows | |
| ASWS-7 Incentives for Dry-Year Releases from Ponds | Current and Future Surface Water Use in Gap Areas | Agricultural Surface Withdrawal | Develop strategy and work with potential participants/ impacted users to increase support for and implementation of strategy | N/A | Examine opportunities to modify farm and other pond operations to obtain releases in dry/gap years<br><br>Modify farm and other pond operations to obtain releases in dry/gap years (by 01/2035), if deemed feasible | EPD, GSWCC, Georgia DOA, and Agricultural surface water users in the Altamaha Region for implementation |

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): / Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): | Responsible Parties |
|---|---|---|---|---|---|---|
| **Point Sources – Dissolved Oxygen (PSDO)** | | | | | | |
| PSDO-1 Collect Water Quality Data | Water Quality Gaps | General Wastewater | EPD to work with potentially effected entities as part of permitting process | Collect data to confirm loading and/or receiving stream chemistry (by 01/2020) | N/A | EPD, Municipalities and/or wastewater utilities in the Altamaha Region |
| PSDO-2 Point Discharge Relocation | | | | Identify feasibility to move discharge location to higher flow streams with greater assimilative capacity (by 01/2015) | If feasible and cost effective, relocate discharge location (by 01/2025) | |
| PSDO-3 Enhance Point Source Treatment | Water Quality Gaps | General Wastewater | Confirm wastewater facilities to upgrade/improve treatment to address low dissolved oxygen conditions in receiving streams | Upgrade/improve treatment of identified wastewater facilities | Continue to upgrade/improve treatment of identified wastewater facilities (by 01/2040) | Municipalities and/or wastewater utilities in the Altamaha Region |



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|---|---|---|---|---|---|---|
| **Available Industrial Wastewater Permit Capacity (IWWPC)[2]** | | | | | | |
| IWWPC-1 Collect Additional Industrial Permit Data | Wastewater Permit Capacity Gap | Industrial Wastewater | Obtain additional permit data on flow volumes and permit conditions for industrial wastewater facilities forecasted needs | Expand or construct new facilities and/or obtain additional wastewater permit capacity to meet forecasted needs (by 01/2020) | N/A | EPD, Industrial wastewater facilities in the Altamaha Region |
| **Available Municipal Groundwater Permit Capacity (MGWPC)** | | | | | | |
| MGWPC-1 Increase Municipal Groundwater Permit Capacity | Groundwater Permit Capacity Gap (Emanuel, Evans, Jeff Davis, Wheeler, and Wilcox Counties) | Municipal Groundwater Withdrawal | EPD and entities to confirm assumptions and needs | Evaluate short-term needs and, if needed, work with EPD to obtain additional permit capacity (by 01/2020) | Evaluate long-term needs and, if needed, work with EPD to obtain additional permit capacity (by 01/2050) | EPD, Municipal water utilities in the Altamaha Region |

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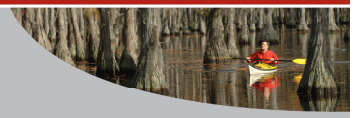
|---|---|---|---|---|---|---|
| **Available Industrial Groundwater Permit Capacity (IGWPC)** | | | | | | |
| IGWPC-1 Increase Industrial Groundwater Permit Capacity | Groundwater Permit Capacity Gap (Evans and Wayne Counties) | Industrial Groundwater Withdrawal | EPD and entities to confirm assumptions and needs | Evaluate short-term needs and, if needed, work with EPD to obtain additional permit capacity (by 01/2020) | Evaluate long-term needs and, if needed, work with EPD to obtain additional permit capacity (by 01/2050) | EPD, Industrial water facilities in the Altamaha Region |
| **Groundwater (GW)** | | | | | | |
| GW-1 Sustainable Groundwater Use<br><br>GW-2 Research Groundwater Sustainability | Future Groundwater Needs (Emanuel, Evans, Jeff Davis, Wheeler, and Wilcox Counties) | Groundwater Withdrawal (Municipal, Industrial, and Agricultural) | Continue to drill wells and withdraw groundwater to meet regional needs<br><br>Verify sustainable yield metrics and consider relevant localized impacts | Provide guidance and implement sustainable groundwater withdrawal rates through 01/2020 | Modify Resource Assessments and sustainable yield criteria, if necessary (by 01/2050) | Municipal, Industrial, Agricultural users in the Altamaha Region, EPD, GSWCC |



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|---|---|---|---|---|---|---|
| GW-3 Promote Aquifer-Friendly Land Use | | N/A | Monitor land use changes and further delineate aquifer recharge areas | Encourage land use practices that sustain and protect aquifer recharge areas (by 01/2020) | Continue to monitor land use and hydrologic relationships | EPD, Municipalities within the Altamaha Region |
| **Surface Water (SW)** | | | | | | |
| SW-1 Maintain Current Permitted Capacity | Current and Future Surface Water Use Outside Gap Areas | Surface water Withdrawal | Confirm non-gap areas and available surface water resource capacity | Continue to apply for permits and use surface water in non-gap areas within available resource capacity (by 01/2020) | Verify flow conditions and gaps | EPD, applicable federal agencies, and surface water users in Altamaha Region |
| SW-2 Monitor and Evaluate Estuaries | | N/A | Monitor Atlantic slope river flow conditions | Determine flow conditions that sustain estuary health (by 01/2020) | N/A | EPD, Coastal Resources Division, Wildlife Resources Division |

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): / Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): | Responsible Parties |
|---|---|---|---|---|---|---|
| **Non-Point Sources (NPS) – Urban, Rural, Agricultural and Forestry Uses** | | | | | | |
| NPS-1 Study Human Impacts on Water Quality | Water Quality Outside Gap Areas | Stormwater (NPDES Discharges) | Collect data to determine dissolved oxygen, fecal coliform, and nutrient sources | Confirm sources of loading and develop programs to address (by 01/2025) | N/A | EPD, Municipalities and Utilities within the Altamaha Region |
| NPS-2 Research and Address Impairment Issues | | | | | | |
| NPSU-1 through NPSU-5 Various Management Practices Related to Stormwater Uses | | | Select best management practices (BMPs) needed for treating stormwater from urban and rural uses | Implement a variety of stormwater BMPs related to urban uses and dirt road maintenance (by 01/2020) | | |
| NPSR-1 Advocate Implementing Road Runoff BMPs | | | | | | EPD, Counties (Public Works/Roads and Bridges Departments) within the Altamaha Region |

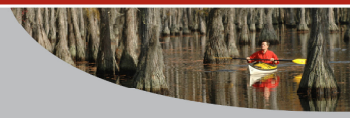

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): Further Action to Complete Implementation and Associated Dates | Responsible Parties |
|---|---|---|---|---|---|---|
| NPSF-1 through NPSF-3 Various Management Practices Related to Forestry Uses | Water Quality Outside Gap Areas | Stormwater (NPDES Discharges) | Continue to support BMP programs | Implement a variety of BMPs related to forestry and agricultural uses (by 01/2020) | N/A | Georgia Forestry Commission (GFC), and possibly county commissions |
| NPSA-1 through NPSA-5 Various Management Practices Related to Agricultural Uses | | | | | | GSWCC, Agricultural users within the Altamaha Region |

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): Further Action to Complete Implementation and Associated Dates | Responsible Parties |
|---|---|---|---|---|---|---|
| TMDL-1 through TMDL-3<br>Evaluate Impaired Segments and Sources | Water Quality Outside Gap Areas | Stormwater (NPDES Discharges) | Collect data to confirm impairment and determine sources | Remove streams listed due to "natural sources" (by 01/2020)<br><br>Refine river/stream reach length for impaired waters (by 01/2025) | Continue collecting data to monitor impairment sources and support reassessment of stream segment classifications (by 01/2050) | EPD, Municipalities and Utilities within the Altamaha Region |
| NUT-1<br>Link Nutrient Loading With Current Land Use | Water Quality Outside Gap Areas | Stormwater (NPDES Discharges) | Align current land use with nutrient loading data to optimize management practice based on consideration of land uses and actual nutrient loading | Support research and development of tools such as the Southern Group of State Foresters and USFS Sediment Prediction modeling tool being developed by Auburn University (by 01/2025) | N/A | EPD, GSWCC, GFC, Municipalities and Utilities within the Altamaha Region, and county commissions |

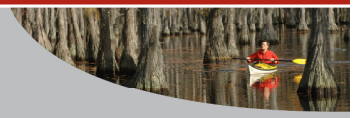

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): | Responsible Parties |
|---|---|---|---|---|---|---|
| **Educational Practices (EDU)** | | | | | | |
| EDU-1 through EDU-4 Various Educational and Outreach Programs on Conservation /Water Quality | Education/ Outreach Support | Entities' Applicable Programs | Develop educational programs on water conservation, septic system maintenance, and stormwater management | Complete educational programs on water conservation, septic system maintenance, and stormwater management | Continue educational programs on water conservation, septic system maintenance, and stormwater management | EPD, State Agencies with WCIP responsibilities, GFC, Municipalities and Utilities within the Altamaha Region |
| EDU-5 Stream Clean-up Events | Education/ Resource Improvement | Entities' Applicable Programs | Encourage coordinating and arranging of clean-up events | Complete clean-up events | Continue clean-up events | EPD, Municipalities and Utilities within the Altamaha Region, Adopt-a-Stream organizations, Riverkeepers, and other applicable non-governmental entities |

**Table 7-1: Implementation Schedule**

| Management Practice Number (See Table 6-1) | Issues to be Addressed and Resource(s) Affected | Permittee Category of Responsible Parties (if applicable) | For All Actions: Initial Implementation Step(s) | For Short-term Actions (2015-2025): / Further Action to Complete Implementation and Associated Dates | For Long-term Actions (2025-2050): | Responsible Parties |
|---|---|---|---|---|---|---|
| **Ordinance and Code Policy Practices (OCP)** | | | | | | |
| OCP-1 through OCP-3 Stormwater Management through Ordinance/ Code Updates and Integrated Planning | Ordinances and Code Policies | N/A | Identify ordinances and standards to implement/update on stormwater and land development (including green space)<br><br>Encourage coordinated environmental planning | Identify and implement strategies for stormwater management to help improve water quality (by 01/2025)<br><br>Conduct regional environmental planning (e.g., land use, stormwater, wastewater) | N/A | EPD, Regional Commissions, Municipalities and Utilities within the Altamaha Region, and county commissions |

Notes:

[1]Seek to reduce frequency and severity of human impacts to 7Q10 low flow conditions in the Altamaha Region, which are associated with agricultural water use in portions of the region. Focus on surface water permit holders and new surface water permit requests in Canoochee Watershed [(Candler, Evans, Emanuel, Tattnall, and Bulloch Counties (Claxton Gap)], Alapaha Watershed [Wilcox County (Statenville Gap)], Ogeechee Watershed [Candler, Evans, Emanuel Counties (Eden and Kings Ferry Gap)], and Satilla Watershed [Appling, Jeff Davis, and Wayne Counties (Atkinson Gap)].

[2]Additional industrial wastewater capacity may be needed. EPD to update and refine discharge limit databases to confirm flow and quality assumptions.

## 7.2. Fiscal Implications of Selected Water Management Practices

The following subsections discuss planning level cost estimates for the water management practices selected by the Altamaha Council and potential funding sources and options. Successful implementation of the Regional Water Plan is highly dependent on the ability of state and local governments, water providers, and utilities to fund the needed implementation actions.

### Planning Level Cost Estimates

Planning level cost estimates were prepared for each management practice as shown in Table 7-2 using planning guidance documents, the knowledge base of previous state and utility planning efforts, availability of quantifiable data, and other sources of information, as listed below. The guidance documents and sources used to inform the planning level cost information in Table 7-2 have not been updated. Accordingly, the values shown below should only be used as a general guide. Specific costs should be further evaluated and updated before being relied upon.

- Georgia Environmental Protection Division Supplemental Guidance for Planning Contractors: Water Management Practice Cost Comparison dated March 2010 (Revised March 2011).
- Water Conservation Analysis Technical Memorandum to Supplement Council's Plan prepared by CDM for Georgia EPD draft dated July 2011.
- CDM Water Supply Cost Estimation Study prepared for the South Florida Water Management District dated February 2007.
- EPA Report titled Costs of Urban Stormwater Control Practices – Preliminary Report dated February 5, 2006.
- EPA Report titled Costs of Urban Stormwater Control dated January 2002.
- St. Johns River Water Management District Report titled Water Supply Needs and Sources Assessment Alternative Water Supply Strategies Investigation, Water Supply and Wastewater Systems Component Cost Information dated 1997 (Publication Number SJ97-SP3).
- Preliminary estimates of production well yields and costs from local licensed well drillers in Georgia (Bishop Well and Pump Service and Grosch Irrigation Company.)
- Irrigation Conservation Practices Appropriate for the Southeastern United States. Project Report 32. Prepared in cooperation with the Georgia DNR, EPD under Proposal No. ES61135FC1.

- Groundwater Flow Modeling of the Coastal Plain Aquifer System of Georgia. Draft Report completed for EPD as part of State of Georgia Groundwater Resource Assessment (December 2009).
- FY 2004 Sussex Conservation District Cover Crop Program Fact Sheet. Sussex Conservation District, Georgetown, Delaware. Dated 2003.
- North Carolina State University Department of Forestry Costs of Forestry Best Management Practices in the South: A Review.
- Recent bid tabulations (as of 2011) for wastewater treatment facilities.

The cost estimates are unit cost estimates where there is a lack of detail or specificity about the management practice. For example, for an inter-basin transfer of water, the cost is driven by the length and size of the pipeline and the quantity to be transferred. If the connection locations and or the transfer quantity are not known, a unit cost per mile of pipeline is given. Where there is detail about the management practice, unit cost data were used to develop an approximate capital/programmatic cost. The capital costs were adjusted to 2010 dollars using the Engineering News Record Cost Index. In summary, some cost estimates are unit costs with different unit basis and some costs are approximate capital costs. Therefore, each management practice is assigned a cost (where applicable) rather than rolling up the costs into general categories since they may not be additive. The cost information provided in this document will be used to pursue loans, grants, and other funding options that can be prioritized throughout the region.

## Funding Sources and Options

Several different funding sources and options will be used to secure funding for the different management practices outlined in this Plan including:

- The State Revolving Fund Program
- Other State of Georgia Funding Programs
- State and Federal Grants
- Water/Wastewater System Revenues
- State and local government incentive programs

More details on potential loan and grant programs are provided for the management practices in Table 7-2. Below is a list of some of the larger organizations and agencies that provide funding for the types of management practices recommended in this Plan. It is important to note that funding sources and opportunities change on a yearly basis.

Environmental Protection Agency (EPA) Programs

The EPA provides grants to States, non-profits, and educational institutions to support high-quality research that will improve the scientific basis for decisions on national environmental issues and help the EPA to achieve its goals. The EPA provides research grants and graduate fellowships; supports environmental education projects that enhance the public's awareness, knowledge, and skills to make informed decisions that affect environmental quality; offers information for State and local governments and small businesses on financing environmental services and projects; and provides other financial assistance through programs such as the Drinking Water State Revolving Fund (DWSRF), the Clean Water State Revolving Fund (CWSRF), and the Brownfield Program. More information on the EPA can be accessed at: www.epa.gov.

The EPA offers the following grant programs:

- Continuing Program Grants
- Project Grants
- Clean Water State Revolving Fund Program
- Water Pollution Control Program
- Water Quality Cooperative Agreements Program
- Water Quality Management Planning Program
- Onsite Wastewater Management Planning Program
- Drinking Water State Revolving Fund Loan Program

Georgia Environmental Protection Division (EPD)

The mission of EPD is to help provide Georgia's citizens with clean air, clean water, healthy lives and productive land by assuring compliance with environmental laws and by assisting others to do their part for a better environment. As a result of the Clean Water Act, each year the State of Georgia receives funding from the U.S. Environmental Protection Agency to assist the State with addressing environmental issues. EPD offers the following grant programs:

- Section 319 (h) Grants
- Section 604 (b) Grants

U.S. Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS) Conservation Programs

The USDA-NRCS offers a number of funding opportunities as a result of the Farm Security and Rural Investment Act of 2002. This Act is landmark legislation for conservation funding and for focusing on environmental issues. The conservation provisions will assist farmers and ranchers in meeting environmental challenges on their land. This legislation simplifies existing programs and creates new programs to address high priority environmental and production goals. The USDA-NRCS offers the following funding options:

- Agricultural Conservation Easement Program
- Conservation of Private Grazing Land Program
- Environmental Quality Incentives Program
- Resource Conservation and Development Program

**Table 7-2: Cost Estimates for the Implementation Responsibilities**

| Management Practice No. (See Table 6-1) | Issues to be Addressed | Capital/ Programmatic Cost | Funding Sources and Options[1] | Notes and Sources for Costs |
|---|---|---|---|---|
| **Data Collection/Additional Research (DCAR)** | | | | |
| DCAR-1 Agricultural Consumption Data | Surface Water Gaps | $0.25M | State incentive programs | Various recent similar projects |
| DCAR-2 Source of Supply Data to Refine Forecasts | | $0.5M | Local governments; State incentive programs | |
| DCAR-3 Metering Data | | $0.5M | | |
| DCAR-4 Support Irrigation Efficiency Research | | $0.2M | | |
| DCAR-5 Irrigation Education and Research | | $0.1M | | |
| DCAR-6 Minimize Groundwater Use Impacts on Surface Water | | $0.05M | | |
| DCAR-7 Address Low Flow with Wetland Restoration and Retention Structures | | $0.125M | | |
| DCAR-8 Analyze Addressing Extreme Conditions | | $0.15M | | |
| **Water Conservation (WC)** | | | | |
| WC-1 Tier 1 and Tier 2 Measures for Municipal and Industrial Users | Surface Water Gaps | $0.1M to $0.2M | Local governments; utilities | Supplemental Guidance |

| Table 7-2: Cost Estimates for the Implementation Responsibilities | | | | |
|---|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Issues to be Addressed** | **Capital/ Programmatic Cost** | **Funding Sources and Options[1]** | **Notes and Sources for Costs** |
| WC-2<br>Tier 1 and Tier 2 Measures for Agriculture | | $0.1M to $0.2M | | |
| WC-3<br>Audits | | $1,300/system | State/federal loan or grant | Irrigation Conservation Practices Appropriate for the Southeastern United States |
| WC-4<br>Metering | | $2.7M | | (3,026 existing irrigation pumps) times 10% increase in pumps times $800/totalizer |
| WC-5<br>Inspections | | $0 to $0.25M | | $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| WC-6<br>Minimize High-Pressure Systems | | $4,700/system | | Irrigation Conservation Practices Appropriate for the Southeastern United States |
| WC-7<br>Efficient Planting Methods | | $0.1M to $0.2M | | Educate farmers on benefits of cropping and crop rotation |
| WC-8<br>Conservation Tillage | | $0.1M to $0.2M | | Educate farmers on benefits of conservation tillage |
| WC-9<br>Control Water Loss | | $0.1M to $0.2M | | Educate farmers on practices to prevent water loss through more efficient detention of rainfall |
| WC-10<br>End-Gun Shutoffs | | $700/system | | Irrigation Conservation Practices Appropriate for the Southeastern United States |
| WC-11<br>Low Pressure Systems | | $3,400/system | | |
| WC-12<br>Application Efficiency Technologies | | $2,000/system | | |
| **Additional/Alternatives to Existing Surface Water Supply Sources (ASWS)** | | | | |
| ASWS-1<br>Incentives for Sustainable Groundwater Development | Surface Water Gaps | $0.01M to $0.1M per MGD | State incentive programs | From local well driller data and Supplemental Guidance. Includes only cost of supply. This is a high priority management practice. |

**Table 7-2: Cost Estimates for the Implementation Responsibilities**

| Management Practice No. (See Table 6-1) | Issues to be Addressed | Capital/ Programmatic Cost | Funding Sources and Options[1] | Notes and Sources for Costs |
|---|---|---|---|---|
| ASWS-2 Land Management Incentives | | $0 to $1 per capita | State incentive programs | Supplemental Guidance. Total population in 2050: 374,565. This is a high priority management practice. |
| ASWS-3 Incentives for Greater Wastewater Returns | | $0.1M to $1M per MGD | State incentive programs; utilities | Supplemental Guidance. This is a high priority management practice. |
| ASWS-4 Monitor Gap Closure and Manage Adaptively | | $1M to $2M | | Various recent similar projects. This is a medium priority management practice. |
| ASWS-5 Restoration Incentive Programs | | $5,000 to $9,000 per credit | | Supplemental Guidance. The costs are based on the cost to purchase credits from a restoration bank. This is a medium priority management practice. |
| ASWS-6 Consider Low-Flow Conditions in Future Surface Water Permitting | Surface Water Gaps | $0.15M to $0.2M per applicant | State incentive programs; utilities | Various recent similar projects. Includes modeling, permit application and monitoring. This is a low priority management practice. |
| ASWS-7 Incentives for Dry-Year Releases from Ponds | | $1M to $2M | State incentive programs | Various recent similar projects. This is a low priority management practice. |
| **Point Sources – Dissolved Oxygen (PSDO)** | | | | |
| PSDO-1 Collect Water Quality Data | Water Quality Gaps | $0.25M to $0.5M | Local governments; utilities | Various recent similar projects |
| PSDO-2 Point Discharge Relocation | | $0.1M to $0.3M | GEFA Georgia Fund Loan; utilities | |
| PSDO-3 Enhance Point Source Treatment | | $7M to $10M per MGD | | Supplemental Guidance |

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**Table 7-2: Cost Estimates for the Implementation Responsibilities**

| Management Practice No. (See Table 6-1) | Issues to be Addressed | Capital/ Programmatic Cost | Funding Sources and Options[1] | Notes and Sources for Costs |
|---|---|---|---|---|
| **Available Industrial Wastewater Permit Capacity (IWWPC)** | | | | |
| IWWPC-1 Collect Additional Industrial Permit Data | Wastewater Permit Capacity Gap | $0.1M to $0.2M | | Various recent similar projects |
| **Municipal Groundwater Permit Capacity (MGWPC)** | | | | |
| MGWPC-1 Increase Municipal Groundwater Permit Capacity | Groundwater Permit Capacity Gap | $0.25M to $0.5M | Drinking Water State Revolving Fund (DWSRF) Loan Program | Various recent similar projects |
| **Industrial Groundwater Permit Capacity (IGWPC)** | | | | |
| IGWPC-1 Increase Industrial Groundwater Permit Capacity | Groundwater Permit Capacity Gap | $0.25M to $0.5M | DWSRF Loan Program | Various recent similar projects |
| **Groundwater (GW)** | | | | |
| GW-1 Sustainable Groundwater Use | Future Groundwater Needs | $0.01M to $0.1M per MGD | Georgia Reservoir and Water Supply Fund | Supplemental Guidance |
| GW-2 Research Groundwater Sustainability | | $0.2M to $0.4M | | State of Georgia Groundwater Resource Assessment |
| GW-3 Promote Aquifer-Friendly Land Use | | $750 to $8,500 per MGD | State incentive programs | Supplemental Guidance |
| **Surface Water (SW)** | | | | |
| SW-1 Maintain Current Permitted Capacity | Current and Future Surface Water Uses Outside Gap Areas | $0.05M to $0.1M per applicant | Local governments; utilities | Includes cost of permitting and impact evaluation |
| SW-2 Monitor and Evaluate Estuaries | | $0.1M to $0.15M | | Various recent similar projects |

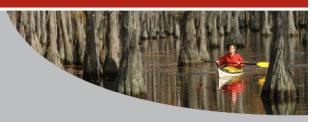


**Table 7-2: Cost Estimates for the Implementation Responsibilities**

| Management Practice No. (See Table 6-1) | Issues to be Addressed | Capital/ Programmatic Cost | Funding Sources and Options[1] | Notes and Sources for Costs |
|---|---|---|---|---|
| **Dissolved Oxygen, Fecal Coliform, Nutrients, and Other Impairments** | | | | |
| NPS-1 Study Human Impacts on Water Quality | Future Water Quality Non-Point Source (NPS) Needs | $0.2M to $0.4M | Clean Water Act Section 319(h) Grants (NPS Implementation Grant) | EPA Manual of Costs of Urban Stormwater Control (2002) |
| NPS-2 Research and Address Impairment Issues | | $0.5M to $1.5M | | Various recent similar projects |
| **Urban Best Management Practices (NPSU)** | | | | |
| NPSU-1 Control Erosion | Future Water Quality NPS Needs | $0 to $ $0.37M | Clean Water Act Section 319(h) Grants; (NPS Implementation Grant) | $0 to $1 per capita. Total population in 2050: 374,565 |
| NPSU-2 Manage Stormwater Runoff | | $6,000 to $65,000 per MG | | EPA Manual of Costs of Urban Stormwater Control (2002) |
| NPSU-3 Increase Stormwater Infiltration | Future Water Quality NPS Needs | $0 to $0.25M | Clean Water Act Section 319(h) Grants; (NPS Implementation Grant) | $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| NPSU-4 Riparian Buffers | | $0 to $0.25M | GEFA Land Conservation Program | |
| NPSU-5 Street Sweeping | | $0.4M to $0.8M | Clean Water Act Section 319(h) Grants; (NPS Implementation Grant) | $1 to $2 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| **Rural Best Management Practices (NPSR)** | | | | |
| NPSR-1 Advocate Implementing Road Runoff BMPs | Future Water Quality NPS Needs | $2,500 to $75,000 per mile of swale | 319(h) Grants; (NPS Implementation Grant) | EPA Manual of Costs of Urban Stormwater Control (2002) |

| Table 7-2: Cost Estimates for the Implementation Responsibilities | | | | |
|---|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Issues to be Addressed** | **Capital/ Programmatic Cost** | **Funding Sources and Options[1]** | **Notes and Sources for Costs** |
| **Forestry Best Management Practices (NPSF)** | | | | |
| NPSF-1 Support Forestry Commission Water Quality Program | Future Water Quality NPS Needs | Continue to fund existing programs | | |
| NPSF-2 Improve BMP Compliance | | Continue to fund existing programs | | Costs of Forestry Best Management Practices in the South: A Review |
| NPSF-3 Wetland and Forest Restoration Incentives | | $5,000 to $9,000 per credit | Federal grants | Supplemental Guidance. The costs are based on purchasing credits from a restoration bank. |
| **Agricultural Best Management Practices for Crop and Pasture Lands (NPSA)** | | | | |
| NPSA-1 Soil Erosion Reduction Measures | Future Water Quality NPS Needs | $0.1M to $0.2M | | Conservation tillage and cover crop |
| NPSA-2 Utilize Buffers | | $0 to $0.25M | | $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| NPSA-3 Livestock Management | Future Water Quality NPS Needs | $0 to $0.25M | | $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| NPSA-4 Manure Control | | $0.5M to $1M | | Sussex (Delaware) Conservation District Cover Crop Program Fact Sheet |
| NPSA-5 Wetland and Forest Restoration Incentives | | $5,000 to $9,000 per credit | | Supplemental Guidance. The costs are based on the cost to purchase credits from a restoration bank. |
| **Total Maximum Daily Load Listed Streams (TMDL)** | | | | |
| TMDL-1 Evaluate Impairment Sources | Future Water Quality NPS Needs | $0.5M to $1M | | Various recent similar projects |

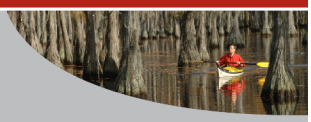


**Table 7-2: Cost Estimates for the Implementation Responsibilities**

| Management Practice No. (See Table 6-1) | Issues to be Addressed | Capital/ Programmatic Cost | Funding Sources and Options[1] | Notes and Sources for Costs |
|---|---|---|---|---|
| TMDL-2 Analyze Impaired Segments and Sources | | $35,000 to $130,000 per impairment | | Various recent similar projects |
| TMDL-3 Stormwater Management BMPs | | $19M to $30M | | $50 to $80 per capita. Total population in 2050: 374,565 |
| **Nutrients –Regional Watershed Models (NUT)** | | | | |
| NUT-1 Link Nutrient Loading With Current Land Use | Future Water Quality NPS Needs | $10 to $150 per acre | | Supplemental Guidance |
| **Educational (EDU)** | | | | |
| EDU-1 Promote Conservation Programs | Future Educational Needs | $0 to $0.85M | State incentive programs; utilities; local governments | $0 to $2.25 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| EDU-2 Stormwater Education | | $0 to $0.85M | | $0 to $2.25 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| EDU-3 Septic System Maintenance Education | Future Educational Needs | $0 to $0.25M | State incentive programs; utilities; local governments | $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| EDU-4 Forestry BMP Education | | $0.05M to $0.15M | | Support Georgia Forestry BMPs |
| EDU-5 Clean-Up Events | | $0.05M to $0.1M | | Various recent similar projects |
| **Ordinance and Code Policy (OCP)** | | | | |
| OCP-1 Engage Local Governments | Future Ordinance and Code Policy Needs | $0 to $0.25M | State incentive programs; local governments; utilities | $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |

| Table 7-2: Cost Estimates for the Implementation Responsibilities | | | | |
|---|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Issues to be Addressed** | **Capital/ Programmatic Cost** | **Funding Sources and Options[1]** | **Notes and Sources for Costs** |
| OCP-2 Green Space Opportunities and Incentives | | $0 to $0.25M | State incentive programs; utilities, local governments; Georgia Land Conservation Program | Green space incentives $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| OCP-3 Promote Integrated Planning | | $0 to $0.25M | State incentive programs; utilities; local governments | $0 to $0.7 per capita per Supplemental Guidance. Total population in 2050: 374,565 |
| [1] Where referenced, GEFA-administered loan programs (e.g., CSWRF, DWSRF) are intended to finance eligible activities related to construction of water infrastructure projects, including site-specific engineering and planning efforts. | | | | |

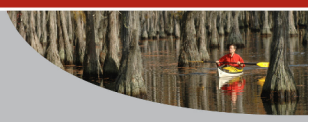
## 7.3. Alignment with Other Plans

The Altamaha Council's Plan and management practices selection process was based on identifying and supporting existing policy, planning, and projects. Local comprehensive plans, planned and/or permitted projects were relied upon in developing the Regional Water Plan. This approach is tailored to maintain consistency with, and to maximize support for, locally driven water resource management decisions. The Altamaha Council did identify potential challenges associated with both the cost and technical issues that the region may face; especially regarding water and wastewater needs for both new and aging infrastructure. In addition, addressing existing surface water gaps must be accomplished in a manner that does not cause adverse impacts to local water users and local governments.

The challenges of funding Plan recommendations and addressing future technical and regulatory issues is especially difficult for smaller towns and utilities, agricultural water uses, and small businesses that rely on natural resources. The successful implementation of the Regional Water Plan will be dependent on the principles of support and leadership by state agencies, in a collaborative setting, utilizing incentives, and financial assistance to the extent possible.

## 7.4. Recommendations to the State

The Altamaha Council supports the concept of regional water resource planning with a focus on planning Councils composed of local governments, water users, water providers, industry, business, and affected stakeholders. Local representatives are typically most familiar with local water resource issues and needs. The State has a vital role providing technical support, guidance, and funding to support locally focused water resource planning. This Plan should be viewed as a living, iterative document and the State should focus on the following principles:



## Education, Incentives, Collaboration, Cooperation, Enabling, Supporting

The Altamaha Council is sensitive to unintended consequences if Plan recommendations become mandates. The State must help balance Plan recommendations with assessing measurable progress toward Plan implementation. If additional rules or other administrative or regulatory actions are deemed necessary, the State should work with Councils to help ensure workable solutions.

The following specific recommendations to the State are provided to help aid in the successful implementation of the Plan.

Georgia Environmental Protection Division (EPD)

- Consider "institutionalizing" planning. This would entail a long-term commitment of staff and funding to: monitor and support Plan recommendations; coordinate improved data collection, management and analysis; continue to develop and improve Resource Assessment tools; and help provide funding, permitting and technical support to address gaps and water resource needs.

- Work with EPD's Agricultural Water Withdrawal Permitting and Water Metering Program, as well as other partners, including but not limited to, the University of Georgia and the Georgia Department of Agriculture to improve agricultural water use data collection and management. This effort would focus on refining source(s) of supply for multiple irrigation sources, continuing to assess data on crop water requirements, evaluating the effects of farm ponds on direct irrigation withdrawals and the hydrologic cycle, and further research on crop consumptive use. This data in turn should be coordinated with Resource Assessment tools to ensure accurate simulation of any gaps and assumptions.

- Support completion, maintenance and improvement of the *Agricultural Water Use Measurement Program*, which is aimed at cost effectively collecting agricultural water use data across the State, and integrating cooperative arrangements with the private sector and partnerships with other State agencies. This program is a vital component to helping the State and regions effectively manage and utilize water resources.

- Focus funding support and permitting assistance to projects and programs aimed at addressing gap areas. Where possible, leverage federal funds to help support and expedite project implementation.

- Consider collaborative approaches to collecting more standardized water use data and improving data on water demands. This would include continued improvement and updating databases used in the planning process. It would also involve working with the Georgia Municipal Association, Georgia Association of County Commissioners, and other relevant stakeholders to improve water use information.

- Working with Georgia Environmental Finance Authority, examine opportunities to improve coordination among water providers and users and create incentives to maximize existing infrastructure and coordinated operations.

- Continue to engage in dialogue and data-sharing with the States of Florida and South Carolina regarding current and forecasted groundwater use. South Georgia, North Florida, and South Carolina rely on the Floridan aquifer to meet water supply needs and it is in EPD's best interest to include the most accurate available information on growth and groundwater use in both states in the Resource Assessment modeling.

Georgia Environmental Finance Authority (GEFA)

- Meeting forecasted water supply needs will require stable and flexible funding sources to assist water users and water and wastewater utilities in meeting forecasted needs. A stable GEFA financing source(s) should be provided for necessary water supply, water and wastewater plant construction and plant upgrades to address current and future gaps.

Georgia Forestry Commission (GFC)

- Continue to support and fund the GFC Forestry Best Management Practices Program. Providing education and incentives to control erosion and segmentation will help the region prevent/address TMDL listed segments, reduce nutrient loadings, and support wetland areas. This will have the benefit of helping to sustain baseflow conditions of streams and water quality.

Georgia Soil and Water Conservation Commission (GSWCC)

GSWCC should continue to provide leadership and locally focused efforts in the following programs:

- Continue education and outreach associated with *Urban Erosion and Sediment Control* program including certification of individuals involved in land disturbing activities and on-site implementation of erosion, sedimentation, and pollution control plans. This will help address the water quality needs of the region.

- Continue education and outreach efforts to agricultural interests to inform farmers of available technologies and funding sources to make more efficient use of water resources without incurring hardship.

- Support *Georgia Agricultural Conservation Incentive* program, which provides funding support to help implement conservation practices that benefit water quantity and quality. Funding for this program is essential to help implement conservation measures, especially in the regional watersheds where there are surface water gaps.

Office of State Planning and Budget (OPB)

- Obtain population census data and compare to population forecasts to track trends in the accuracy of population projections
- Revise population forecasts and support ongoing state-wide planning

Department of Community Affairs (DCA)

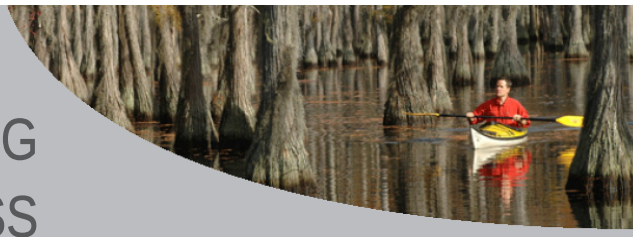
- Identify and encourage local governments to integrate Regional Water Plan management practices with land use and water quality/quantity nexuses into their comprehensive planning efforts.
- Continue to promote coordinated environmental planning

Georgia Department of Agriculture (DOA)

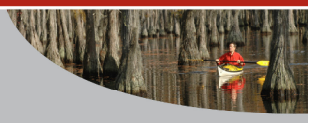
- Provide technical information and participate in needed studies to better characterize agricultural water uses and quantification of shortages to low flow conditions.
- Assist with outreach and education of agricultural users to obtain greater understanding of surface water resource limitations, both quality and quantity, and to help improve the implementation rate of management practices. Assist EPD and other state agencies in coordinating accomplishment of the above goals with the Georgia Farm Bureau.

Georgia Department of Natural Resources [Coastal Resources Division (CRD) and Wildlife Resources Division (WRD)]

- Continue to monitor resources and help sustain, enhance, protect and conserve Georgia's natural, historic, and cultural resources.
- Provide technical and ecosystem information to help support state water planning needs.



# 8. MONITORING AND REPORTING PROGRESS



# Section 8. Monitoring and Reporting Progress

The selected water management practices identified in Section 6 will be primarily implemented (as described in Section 7) by the various water users in the region, including local governments and others with the capacity to develop water infrastructure and apply for the required permits, grants and loans.

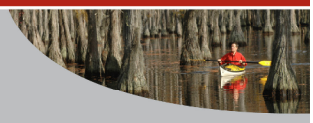
**Summary**

*The Altamaha Council has identified several benchmarks and means to measure progress toward meeting regional needs and goals. In most cases, efforts will require significant coordination between affected water resource managers, and local and state government. Successful implementation will be dependent on adequate financing, leadership and support by state agencies, and collaboration by multiple stakeholders.*

## 8.1. Benchmarks

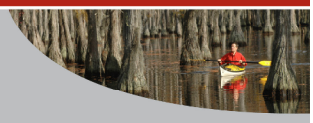
The benchmarks prepared by the Altamaha Council and listed in Table 8-1 below will be used to assess the effectiveness of this Plan's implementation and identify any required revisions. As detailed below, the Altamaha Council selected both qualitative and quantitative benchmarks that will be used to assess whether the water management practices are closing gaps over time and allowing the water planning region to meet its Vision and Goals. Effective implementation of the Plan will require the availability of sufficient funding in the form of loans, and in some cases, possibly grants. In addition, many of the proposed management practices require ongoing coordination with affected stakeholders/water users and collaboration to help ensure successful solutions are identified and implemented. Finally, in many cases monitoring progress toward addressing future needs will require improved data and information on the current actions and management practices that are already in place. The benchmarks will be used to evaluate the Regional Water Plan effectiveness at the next 5-year Plan review and will require collection of information in the intervening years to better quantify and document resource conditions and progress to meeting regional needs and goals. The successful implementation of the Regional Water Plan will require both leadership and supporting roles by EPD, other state agencies, local government and water and wastewater utilities, as well as individual water users.

| Table 8-1: Benchmarks for Water Management Plans | | | |
|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Benchmark** | **Measurement Tools** | **Time Period** |
| **Address Current and Future Surface Water Use in Gap Areas**<br>**Data Collection/Additional Research (DCAR)** to confirm frequency, duration, and severity of agriculturally-driven shortages to 7Q10 low flow conditions | | | |
| DCAR-1 through DCAR-8<br>Various Data Collection and Additional Irrigation and Restoration Research Practices | - Develop Plan of Study, obtain funding and stakeholder participation as needed<br>- Completion of work plans and study implementation and documentation of results<br>- Incorporate data and findings into forecasts, Resource Assessments, and Water Plan updates | - Survey or self-reporting of agencies/entities involved in studies<br>- Verify inputs and revisions to water planning tools | 5 years<br>5 years |
| **Action Needed - Water Conservation (WC)** - Meet current and future gaps and water needs by efficient water use | | | |
| WC-1 and WC-2<br>Tier 1 and Tier 2 Measures for Municipal, Industrial, and Agricultural Users | - Maintain or reduce gallons per capita consistent with Tiers 1 and 2 conservation practices<br>- Implementation of Tiers 1 and 2 agricultural conservation practices | Assess regional municipal, industrial, and agricultural water use rate trends and practices via periodic survey | 2-5 years |
| WC-3 through WC-12<br>Tier 3 and Tier 4 Measures for Agriculture | Reduction in agricultural surface water withdrawals while maintaining agricultural production and reduction in surface water gap areas | - Survey of agricultural conservation practices implementation rates and trends in water use by GSWCC<br>- Assess flow conditions using water use data and Resource Assessment tools (EPD) | 2-5 years |
| **Address Current and Future Surface Water Use in Gap Areas**<br>**Additional/Alternate to Existing Surface Water Supply Sources (ASWS)** | | | |
| ASWS-1<br>Incentives for Sustainable Groundwater Development | -Information and educational materials developed in conjunction with GSWCC and Georgia DOA to communicate issues and goals of improving surface water flows<br>-Methods and incentives identified to increase implementation/participation | - Verify information and educational outreach via survey or direct agency reporting<br>- Monitor and track surface water versus groundwater permit applications | 1-3 years<br>1-5 years |
| ASWS-2 through ASWS-3 | - Feasibility studies completed (for short-term studies) | Reevaluate need during next Regional Water Plan update | 5 years |



| Table 8-1: Benchmarks for Water Management Plans | | | |
|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Benchmark** | **Measurement Tools** | **Time Period** |
| Various land management and wastewater incentive measures | - Feasibility studies initiated (for long-term studies/actions) | | |
| ASWS-4<br>Monitor Gap Closure and Manage Adaptively | - Develop information and educational materials in conjunction with GSWCC and Georgia DOA to communicate issue and goals of improving surface water flows<br>- Identify methods and incentives to increase implementation/participation | Identify and monitor participation and conversion rates from surface water to groundwater | 1-3 years<br>1-5 years |
| ASWS-5<br>Restoration Incentive Programs | Pending feasibility study | Assess research results | 5 years |
| ASWS-6<br>Consider Low-Flow Conditions in Future Surface Water Permitting | - Formation of stakeholder group and consensus reached on new surface water application process in gap areas<br>- Application process and permit conditions developed | Status report from stakeholder group;<br>Report on usage of process and the number of permits issued with conditions | 1-2 years<br>2-4 years |
| ASWS-7<br>Incentives for Dry-Year Releases from Ponds | Incentives and operating conditions identified as part of ASWS-1 | Document and maintain volumetric accounting of participating storage facilities | 2-5 years |
| **Address Water Quality (Dissolved Oxygen Levels) – Point Sources (PSDO)** | | | |
| PSDO-1<br>Collect Water Quality Data | -Resource Assessment assumptions reviewed and, if necessary, new data collection efforts underway/completed<br>-New findings incorporated into updated Resource Assessment data sets | EPD/agency summary report complete verifying assumptions and documentation of new data | 1-4 years |
| PSDO-2<br>Point Discharge Relocation | - Outreach activities to dischargers completed and feasible options have implemented by dischargers | Monitor permit applications and verify | 1-5 years |

| Table 8-1: Benchmarks for Water Management Plans | | | |
|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Benchmark** | **Measurement Tools** | **Time Period** |
| PSDO-3<br>Enhance Point Source Treatment | - EPD to conduct outreach and facilitate improved treatment in low dissolved oxygen reaches | improved data collection for dischargers | |
| **Obtain Additional Municipal and Industrial Water and Wastewater Permit Capacity** | | | |
| IWWPC-1, MGWPC-1, IGWPC-1<br>Expansion of Wastewater and Groundwater Permit Capacities to Address Gaps/Needs | -Outreach activities completed to water providers in high growth areas<br><br>-Need for additional permit capacity verified and improved data for discharges obtained | Monitor permit applications and verify improved data collection for dischargers | 5 years |
| **Addressing Current and Future Groundwater Needs** | | | |
| GW-1<br>Sustainable Groundwater Use | Sufficient permit capacity to meet forecasted needs; through the timely submittal and processing of permit applications | Monitor permit applications and issuance | 1-5 years |
| GW-2<br>Research Groundwater Sustainability | Sound science used to improve data and sustainably manage groundwater resources | Groundwater Resource Assessment updated | 5 years |
| GW-3<br>Promote Aquifer-Friendly Land Use | Counties and local governments consider practices to promote infiltration and aquifer recharge | Evaluate trends in impervious land cover in areas of aquifer recharge | 5 years |
| **Addressing Current and Future Surface Water Needs for Gap and Non-gap Areas** | | | |
| SW-1<br>Maintain Current Permitted Capacity | Sufficient permit capacity exists to meet forecasted needs through timely submittal and processing of permit applications | Monitor permit applications and issuance | 1-5 years |
| SW-2<br>Monitor and Evaluate Estuaries | - Major water resources diversion/storage projects identified<br>- Upstream actions that would significantly impact flow conditions assessed | Monitoring data collected in estuaries and river flow trend data collected and reviewed | 5 years |



| Table 8-1: Benchmarks for Water Management Plans | | | |
|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Benchmark** | **Measurement Tools** | **Time Period** |
| **Programmatic Practices for Water Quality –** the following management practices are associated with the Vision and Goals of the Region and are described in general terms as they are either associated with existing state and local programs or are not yet at a point where implementation frameworks have been established by the State | | | |
| - Nutrient Non-point sources Regional Watershed Models<br>- Urban/Suburban, Rural, Forestry, and Agricultural Non-point source BMPs<br>- Total Maximum Daily Load Listed Streams BMPs | -Additional assessments to align sources of contaminants (point and non-point sources) to water quality impairments and land use types<br>- Continue implementation and assessment of the effectiveness of existing state program including GFC, GSWCC, 319 Water Quality initiatives, and local efforts to improve watershed protection and water quality improvements<br>- Background/natural levels of potential sources established | -Review and assessment of programs and information<br>- Complete summaries of watershed conditions using Resource Assessment tools, improved data collection, and synthesis of relevant state program data | 1-5 years |
| **Management Practices to Support Educational Needs** | | | |
| Support education programs for:<br>- Water Conservation<br>- Stormwater Management<br>- Septic System Maintenance<br>-Logger Education<br>-Forestry BMPs | - Data used to identify where future program efforts will be most effective<br>- Funding for programs maintained or improved | Survey and summarize program effectiveness and success stories | 1- 5 years |
| **Management Practices to Address Ordinance and Code Policy Needs** | | | |
| - Encourage implementation and/or compliance with Stormwater and land development ordinances and/or regulations<br>- Encourage improved coordinated environmental planning | - Select local governments surveyed to identify current knowledge base and recommended areas of improvement<br>- Improved education at state and local government conferences and workshops<br>- Enhanced awareness in Comprehensive Planning by local governments across region | Select follow-up survey of local governments to identify changes and success stories | 1-5 years |

| Table 8-1: Benchmarks for Water Management Plans | | | |
|---|---|---|---|
| **Management Practice No. (See Table 6-1)** | **Benchmark** | **Measurement Tools** | **Time Period** |
| **Shared Resources** | | | |
| Combined management practices for the Claxton, Eden, Kings Ferry, Atkinson, and Statenville gaps (Coastal Georgia, Suwannee-Satilla, Savannah-Upper Ogeechee, Upper Oconee, and Upper Flint Regions) | Regional Council-specific management practices implemented | Evaluate project improvement of surface water flows using gauge data and Resource Assessment tools | 1-5 years |

## 8.2. Plan Updates

Meeting current and future water needs will require periodic review and revision of Regional Water Plans. The State Water Plan and associated rules provide that each Regional Water Plan will be subject to review by the appropriate Regional Water Planning Council every 5 years and in accordance with this guidance provided by the Director, unless otherwise required by the Director for earlier review. These reviews and updates will allow an opportunity to adapt the Regional Water Plan based on changed circumstances and new information arising in the 5 years after EPD's adoption of these plans. These benchmarks will guide EPD in the review of the Regional Water Plan.

The Councils appointed to prepare future Regional Water Plan updates will have the opportunity to review the recommendations of past Plans against current available data to make a determination as to which management practices are still appropriate and which ones need to be revised or augmented to meet changing conditions. Future Councils will also have the ability to judge the effectiveness of practices recommended in previous Plans against available benchmark data. This analysis will reveal which practices are effective and what adjustments are necessary to compensate for less effective practices.

## 8.3. Plan Amendments

The Altamaha Council emphasizes that the recommendations in this Regional Water Plan are based on the best information available at the time the Plan was written. New information and issues that may impact the recommendations should be considered and incorporated into relevant implementation decisions and future Water Plan updates. Future planning efforts should confirm current assumptions and make necessary revisions and/or improvements to the conclusions reached during this round of planning.

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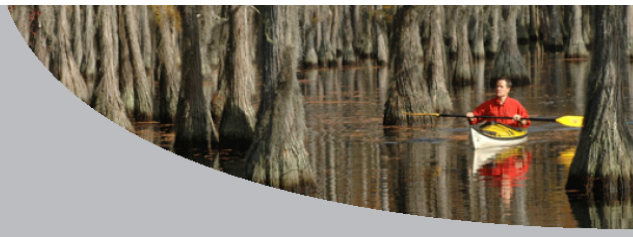

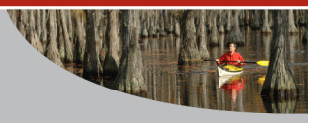

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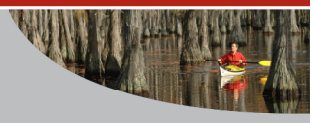

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# APPENDIX A

| Section | Location | Change | Description |
|---|---|---|---|
| ES | Trends and Key Findings | Updated summary box text with the most recent information. | • Population information was updated based on the most recent statewide population projections (Governor's Office of Planning and Budget, 2015).<br>• Updated water use information from the Altamaha Water and Wastewater Forecasting Technical Memorandum (CDM Smith, 2017). |
| ES | Introduction/ Overview | Updated state growth information | • Values for the state of Georgia were updated based on the most recent information from the U.S. Census Bureau. |
| ES | Introduction/ Overview | Minor text revisions/updates | • Text was revised/updated to reflect the purpose of this document as an update to the Plan completed in 2011.<br>• Removal of Council website. |
| ES | Introduction/ Overview | Updated population projections | • Values were updated based on the most recent statewide population projections (Governor's Office of Planning and Budget, 2015). |
| ES | Water Resources and Use, Figure ES-2 | Updated water use information and figures | • Updated water use information based on the most recent information compiled by USGS (2016 USGS Publication). |
| ES | Water and Wastewater Needs, Figure ES-3 | Updated water use information and figure | • Updated water use information based on the most recent information compiled by USGS (2016 USGS Publication). |
| ES | Water and Wastewater Needs, Figure ES-4 | Updated return flow information and figure | • Updated return flow information from the Altamaha Water and Wastewater Forecasting Technical Memorandum (CDM Smith, 2017). |
| ES | Figure ES-5 | Updated figure | • Population information was updated based on the most recent statewide population projections (Governor's Office of Planning and Budget, 2015). |
| ES | Summary of Resource Assessment Results | Updated summary box text with the most recent surface water quality information | • Updated summary of assimilative capacity based on results from Surface Water Quality (Assimilative Capacity) Resource Assessment (EPD, March 2017). |
| ES | Groundwater Availability | Updated/modified text | • Updated sentence structure with word removal. |
| ES | Surface Water Availability | Updated/modified text | • Removed references to Figure ES-6 and replaced with references to Table ES-1.<br>• Removed text describing Figure ES-6 and updated word choice in section.<br>• Updated contribution of agricultural surface water use to current and/or future surface water gaps from 5.32 MGD to 1.1 MGD. |
| ES | Table ES-1 | Replaced Figure ES-6 with Table ES-1 | • Replaced Figure ES-6 with Table ES-1 to describe the forecasted surface water gaps. |
| ES | Assessment of Water Quality Conditions | Updated/modified text | • Updated discussion of water quality impairments based on results from Surface Water Quality (Assimilative Capacity) Resource Assessment (EPD, March 2017).<br>• Added reference (EPD, March 2017).<br>• Replaced Table ES-1 reference to ES-2.<br>• Text was updated for impaired streams and TMDLs. |
| ES | Table ES-2 | Modified table number and updated information | • Because Table ES-1 was added (see above), subsequent table numbers were revised accordingly. The 2011 Table ES 1 is Table ES-2 in 2017 update.<br>• Table updated based on results from Surface Water Quality (Assimilative Capacity) Resource Assessment (EPD, March 2017). |

| Section | Location | Change | Description |
|---|---|---|---|
| ES | Identifying Water Management Practices to Address Water Resources Shortfalls and Future Needs | Updated/modified text | • Updated EPD reference from 2010 to 2017.<br>• Added additional wording to modify language about Regional Water Plan.<br>• Updated Table reference from ES-2 and ES-3 to ES-3 and ES-4. |
| ES | Table ES-3 | Modified table number | • Because Table ES-1 was added (see above), subsequent table numbers were revised accordingly. The 2011 Table ES 2 is Table ES-3 in 2017 update. |
| ES | Table ES-4 | Modified table number | • Because Table ES-1 was added (see above), subsequent table numbers were revised accordingly. The 2011 Table ES 3 is Table ES-4 in 2017 update. |
| ES | Implementing Water Management Practices | Updated/modified text | • Updated Table reference from ES-7 to ES-6. |
| ES | Figure ES-7 | Modified figure number | • Because Figure ES-6 was removed, subsequent figure numbers were revised accordingly. The 2011 Figure ES-7 is Figure ES-6 in 2017 update. |
| 1 | Section 1.0 | Minor text revisions/updates in first three paragraphs of Introduction. | • Text was revised/updated to reflect the purpose of this document as an update to the Plan completed in 2011. |
| 1 | Section 1.0 | Added fourth paragraph to Introduction. | • Added a brief description of the purpose of the Regional Water Plan update process and resulting changes to the revised management practices. |
| 1 | Section 1.1 | Minor text revisions/updates | • Text was revised/updated to reflect the purpose of this document as an update to the Plan completed in 2011. |
| 1 | Section 1.2 | Minor text revisions/updates | • Text in this section was revised/updated to reflect the purpose of this document as an update to the Plan completed in 2011 and to describe the similar approach to process utilized for the Plan update. |
| 1 | Section 1.3 | Updated to current Altamaha Council member numbers. | • Updated Altamaha Council member numbers, including positions of alternates in first paragraph. |
| 1 | Figure 1-3 | Updated to current Altamaha Council member numbers cities. | • Updated Altamaha Council member location cities in the map showing each county in the council. |
| 1 | Section 1.3 | Minor text revisions/updates | • Text in this section was revised/updated to reflect the purpose of this document as an update to the Plan completed in 2011 and to describe the similar approach to process utilized for the Plan update. |
| 1 | Section 1.3 | Revised website references | • Website links for the Memorandum of Agreement, Vision and Goals, Public Involvement Plan, and Public Outreach Technical Memorandum were updated or removed because they were no longer valid. Please refer to the Council's website if link is not available in the document. |
| 2 | Section 2.1 | Updated percentage of groundwater supplied from the Floridan aquifer system | • Updated percentage of groundwater supplied to the Altamaha Planning Region from the Floridan aquifer system based on new 2015 forecasted groundwater withdrawal information. |
| 2 | Section 2.1 | Refined climate description | • Refined description of snowfall historical average in climate section. |
| 2 | Section 2.2 | Updated population projection | • Updated population value to the 2015 population projection based on updated reference (Governor's Office of Planning and Budget, 2015). |
| 2 | Section 2.2 and Figure 2-3 | Updated land cover distribution | • Updated land cover distribution based on most recent available information from the University of Georgia Natural Resources Spatial Analysis Laboratory (2008) |
| 2 | Section 2.2 | Updated description of irrigated crops | • Updated description based on the most recent available information in the 2016 agricultural demand assessment. |
| 2 | Section 2.3 | Minor text revisions/updates in second paragraph | • Updated text in second paragraph to reflect that the Regional Plan was completed. |

| Section | Location | Change | Description |
|---|---|---|---|
| 3 | Summary | Minor text revisions/updates | • Updated year and data.<br>• Revised word choice. |
| 3 | Section 3.1 | Updated water use information | • Updated water use information to the most recent information compiled by USGS (2016 USGS Publication).<br>• Removed text related to outdated references. |
| 3 | Figures 3-1 to 3-4 | Updated water use information and figures | • Updated water use information to the most recent information compiled by USGS (2016 USGS Publication). |
| 3 | Section 3.2 | Minor text revisions/updates | • Updated word choice and sentence structure.<br>• Removed text related to outdated references. |
| 3 | Section 3.2.1 | Text revisions/updates | • Text was added to more accurately describe the nature of the Assimilative Capacity Resource Assessment.<br>• Removed text related to outdated references. |
| 3 | Figure 3-5 | Updated | • Figure updated with most recent assimilative capacity model. |
| 3 | Section 3.2.1 - Assimilative Capacity Modeling Section | Text revisions/updates | • Updated word choice and sentence structure.<br>• The Suwannee River Basin was included in the list of Council's in the Altamaha Region.<br>• Text was added after Table 3-1 to provide additional information regarding DO modeling and Figure 3-7. |
| 3 | Table 3-1 | Updated | • Values updated with most recent results of the assimilative capacity assessment. |
| 3 | Section 3.2.1 - Nutrient Modeling Section | Text revisions/updates | • Updated word choice and sentence structure. |
| 3 | Figure 3-6 | Updated | • Values updated with most recent results of the assimilative capacity assessment. |
| 3 | Figure 3-7 | Added | • This figure was added to demonstrate the 2014 Discharge Conditions in the Altamaha Basin.<br>• subsequent figures were renumbered. |
| 3 | Section 3.2.2 - Current Ecosystem Conditions and Instream Uses | Section moved | •Section 3.2.2. was previously Section 3.3 in the 2011 RWP; Sections 3.2.2 (Surface Water Availability) and 3.2.3 (Current Groundwater Availability) in the 2011 RWP are now Sections 3.2.3 and 3.2.4, respectively. |
| 3 | Section 3.2.2 - Impaired Water Bodies | Minor text revisions/updates | • The text was updated with the 2014 percentages of impaired reaches.<br>• Added the EPD website link.<br>• Added text regarding the list of impaired waters.<br>• Removed text related to outdated references. |
| 3 | Figure 3-8 | Updated | • The figure has been updated to show the types of impairments, the surrounding text has also been updated based on the 2014 303(d) list. |
| 3 | Section 3.2.3 | Text revisions/updates | • Updated descriptions of the Surface Water Availability Resource Assessment to more accurately describe the nature of the analysis.<br>•The text was updated to reflect the most recent data and modeling results.<br>• Updated word choice and sentence structure.<br>• Removed text related to outdated references. |
| 3 | Table 3-2 | Revised | • Table was revised to align with the 2017 updates. Values presented are based on the Surface Water Availability Assessment, March 2017, EPD. |
| 3 | Section 3.2.4 | Text revisions/updates | • Updated descriptions of the Groundwater Availability Resource Assessment to more accurately describe the nature of the analysis.<br>• Updated water use information to the most recent information compiled by USGS (2016 USGS Publication). |
| 4 | Summary | Minor text updates | • The text was updated to reflect the revised forecasts. |
| 4 | Section 4 | Minor text updates | • The text was updated for 2015. |

| Section | Location | Change | Description |
|---|---|---|---|
| 4 | Table 4-1 | Updated | • Population projections were updated based on the most recent statewide population projections (Governor's Office of Planning and Budget, 2015). |
| 4 | Section 4.1 - Municipal Water Forecasts Section | Text additions | • Text was added to describe updated methodology utilized during the Plan update. |
| 4 | Former Table 4-2 | Removed | • This table was removed as the revised methodology did not split out the specific contributions from each individual piece of legislation that reduced flush volumes of toilets for passive conservation. |
| 4 | Figure 4-1 | Updated | • This figure was updated to reflect the revised municipal water forecasts. |
| 4 | Section 4.1 - Municipal Wastewater Forecasts Section | Text revisions/updates | • The text was updated for the most recent information available.<br>• A contribution for I/I was not explicitly added under the revised methodology but instead forecasts were based on the reported discharges. Thus the paragraph describing I/I flows was removed.<br>• Text was added regarding septic wastewater and LAS. |
| 4 | Figure 4-2 | Updated | • This figure was updated to reflect the revised municipal wastewater forecasts. |
| 4 | Section 4.2 - Employment Projections Section | Minor text revisions/updates | • The text related to the planning period was updated. |
| 4 | Section 4.2 - Industrial Water Forecasts Section | Minor text revisions/updates | • The text was updated for clarification. |
| 4 | Section 4.2 - Industrial Wastewater Forecasts Section | Minor text revisions/updates | • The text was updated for clarification. |
| 4 | Figure 4-3 | Updated | • This figure was updated to include 2015 data also other values remained the same. |
| 4 | Section 4.3 | Text Updates | • The text was updated to reflect the updated methodology for forecasting agricultural demands that were updated in 2016.<br>• Updated word choice and sentence structure.<br>• The text was updated based on the most recent data. |
| 4 | Table 4-2 | Updated | • Table was renumbered to Table 4-2 because Former Table 4-2 was removed (see above) and subsequent tables were re-numbered.<br>• This table was updated with the revised agricultural forecasts.<br>• Values quoted in surrounding text was also updated based on current information. |
| 4 | Figure 4-4 | Updated | • This figure was updated to reflect the revised agricultural water use forecasts.<br>• The forecast is no longer being split between crop and non-crop values. |
| 4 | Section 4.4 | Text revisions/updates | • The text was updated to reflect the updated energy forecast that was completed in 2016 and updates to the methodology. |
| 4 | Table 4-3 | Updated | • Table was renumbered to Table 4-3 because Former Table 4-2 was removed (see above) and subsequent tables were re-numbered.<br>• The table was updated with the revised thermoelectric water forecasts.<br>• There is no longer a regional portion of unassigned energy sector withdrawals as the Statewide unassigned withdrawals were significantly reduced since the previous round and this was no longer a factor. |
| 4 | Section 4.5 | Minor text revisions/updates | • Updated word choice and sentence structure.<br>• The text was updated based on the most recent data. |
| 4 | Figure 4-5 | Updated | • This figure was updated with the revised water demand totals per sector.<br>• The figure was converted from pie charts to a bar chart to better show the trend of increasing demands. |

| Section | Location | Change | Description |
|---|---|---|---|
| 4 | Figure 4-6 | Updated | • This figure was updated with the revised total wastewater flows.<br>• The figure was converted from pie charts to a bar chart to better show the trend of increasing flows. |
| 5 | Summary | Minor text revisions/updates | • Updated word choice and sentence structure.<br>• The text was updated to reflect the most recent data. |
| 5 | Section 5.1 | Text revisions/updates | • Updated word choice and sentence structure.<br>• Second paragraph, list of counties in the modeled aquifer area was cross checked with the county demands being included as part of the groundwater availability comparison. |
| 5 | Figure 5-1 | Added | • This figure was previously included in the RWP of other councils. It was added to visually show the projected demands compared to the calculated sustainable yield as well as the portion of demand attributed to Suwannee-Satilla in the modeled aquifer area. |
| 5 | Table 5-1 | Updated | • Updated with the latest permitted water withdrawal values and the updated demand forecasts. There are now fewer counties with a projected need for additional future permitted water withdrawal capacity, most likely due to lower demand estimates based on the most recent, readily-available population growth information. |
| 5 | Section 5.2 | Text revisions/updates | • Updated word choice and sentence structure.<br>• The Eden planning node on the Ogeechee River is now part of the potential surface water gap discussion. There is only a small portion of the Altamaha region (northern part of Emanuel county) which drains to the Eden node. The current methodology includes any planning nodes that had drainage areas crossing the Altamaha council area.<br>• Text was added regarding Figure 5-2 and Table 5-2.<br>• The text was updated to reflect the updates to the methodology.<br>• Text related to former Figure 5-1 was deleted. |
| 5 | Table 5-2, and Figure 5-2 | Elements added to replace former Figure 5-1 | • This figure replaced Figure 5-1. Figure 5-2 was added to highlight the portions of the region which drain to a planning node that was identified as having a potential gap.<br>• Table 5-2 contains a summary of the identified potential gaps that was previously included as part of Figure 5-2.<br>• Subsequent tables were renumbered. |
| 5 | Table 5-3 | Added | • Table 5-3 (new) and related text were added based on updated resource assessment information, and in order to provide information regarding the frequency and duration of potential gaps. This information was used in determining the most relevant management practices for addressing the potential gaps.<br>• Subsequent tables were renumbered. |
| 5 | Table 5-4 | Updated | • Values in the table were updated based on the updated demands and the updated potential gaps (former Table 5-2). |
| 5 | Section 5.3 - Future Treatment Capacity Needs Section | Text revisions/updates | • Updated word choice and sentence structure.<br>• The text was updated to reflect the most recent data. No counties are projected to exceed their permitted capacity. |
| 5 | Table 5-5 | Updated | • Table updated with the latest permitted discharge flow values and the updated wastewater flow forecasts.<br>• Two of the previously identified potential gaps for wastewater permitting capacity were eliminated. |
| 5 | Section 5.3 - Assimilative Capacity Assessments Section | Text revisions/updates | • Updated word choice and sentence structure.<br>• The text was updated based on the results of the current assimilative capacity resource assessment.<br>• Text was added regarding the current modeling results. |
| 5 | Table 5-6 | Updated | • Updated based on the results of the current assimilative capacity resource assessment under current permitted conditions. |

| Section | Location | Change | Description |
|---|---|---|---|
| 5 | Figure 5-3 and Figure 5-4 | Replaced former Figure 5-2 | • These figures were reworked to provide a single view of the whole region rather than the individual snapshots provided previously. |
| 5 | Former Figure 5-3 | Removed | • This figure was removed as revised information was not available. The core components of the figure are still included within the text and new figures. |
| 5 | Section 5.3 - Non-Point Source Pollution Section | Minor text revisions/updates | • Updated word choice and sentence structure.<br>• Text was added regarding the Resource Assessment. |
| 5 | Section 5.4 and Table 5-7 | Added | • A summary section was added to recap major finding in the section.<br>• Table 5-7 was added to summarize the counties with specific identified issues. |
| 6 | Section 6.2 | Text revisions/updates | • Revised the discussion to focus on agricultural conservation to address potential surface water availability gaps due to agricultural water use and periods of drought.<br>• The text referencing Table 5-2 and Figure 5-3 was revised.<br>• Deleted references to 7Q10.<br>• The text and descriptions of potential surface water gaps was updated based on most recent gap analysis presented in Section 5. |
| 6 | Table 6-1 | Updated | • The Description/Definition of Action of various management practices was updated to align with 2017 updates and to capture the recommendations made by the council.<br>• Additional updates include:<br>• Management practice DCAR-7 (Study Potential Use of Aquifers to Address Gap) was removed.<br>• Revised management practice numbers because former DCAR-7 was removed.<br>• Management practices for Additional/Alternative to Existing Surface Water Supply Sources (ASWS) were categorized to high priority, medium priority and low priority management practices.<br>• Management practice MWWPC-1 (Increase Wastewater Capacity) was removed.<br>• MWWPC-1 impacted counties were revised (Emanuel, Evans, Jeff Davis, Wheeler, and Wilcox Counties). |
| 7 | Introduction | Updated | • Years of the planning horizon were updated. |
| 7 | Table 7-1 | Updated | • Updated "For All Actions: Initial Implementation Step(s) and Associated Date(s)" and "Further Action to Complete Implementation and Associated Dates" to align with the 2017 updates for multiple management practices.<br>• Additional updates include:<br>• Management practice DCAR-7 (Study Potential Use of Aquifers to Address Gap) was removed.<br>• Revised management practice numbers because former DCAR-7 was removed.<br>• Management practices for Additional/Alternative to Existing Surface Water Supply Sources (ASWS) were categorized to high priority, medium priority and low priority management practices.<br>• Management practice MWWPC-1 (Increase Wastewater Capacity) was removed.<br>• MWWPC-1 impacted counties were revised (Emanuel, Evans, Jeff Davis, Wheeler, and Wilcox Counties).<br>• GW-1 to GW-3 impacted counties were revised (Emanuel, Evans, Jeff Davis, Wheeler, and Wilcox Counties). |
| 7 | Section 7.2 - Planning Level Cost Estimates Section | Added verbiage regarding planning level cost estimate. | • Neither the cost guidance prepared by EPD in April 2011 (“GAEPD Cost Guidance”) nor the cost estimates have been updated therefore EPD recommended cautioning the public. |

| Section | Location | Change | Description |
|---|---|---|---|
| 7 | Section 7.2 - Funding Sources and Options Section | Revised various USDA NRCS funding options. | • The Conservation Security Program (CSP) was not reauthorized in the 2008 Farm Bill and is no longer available.<br>• The Agricultural Act of 2014 (Act) establishes the Agricultural Conservation Easement Program (ACEP) and repeals the Farm and Ranch Lands Protection Program (FRPP). F24ACEP combines the purposes of FRPP and the similarly repealed Grassland Reserve Program (GRP) into the new Agricultural Land Easements (ALE) that protect the agricultural use and conservation values of eligible farm and ranch land.<br>• Wetland Reserve Program: The Agricultural Act of 2014 establishes the Agricultural Conservation Easement Program (ACEP). It repeals FRPP, GRP, and WRP but does not affect the validity or terms of any FRPP, GRP, or WRP contract, agreement or easement entered into prior to the date of enactment on February 7, 2014 or any associated payments required to be made in connection with an existing FRPP, GRP, or WRP contract, agreement or easement.<br>• Wildlife Habitat Incentive Program: The Agricultural Act of 2014 (enacted on February 7, 2014) repealed the Wildlife Habitat Incentive Program (WHIP). NRCS will continue to support existing active WHIP contracts entered into prior to passage of the Agricultural Act of 2014, using the rules and policy in effect at the time of contract obligations. Portions of the WHIP Statute were rolled into the Environmental Quality Incentives Program (EQIP). |
| 7 | Table 7-2 | Updated | • Table was modified to be consistent with Table 6-1.<br>• Management practice DCAR-7 (Study Potential Use of Aquifers to Address Gap) was removed.<br>• Revised management practice numbers for DCAR because former DCAR-7 was removed.<br>• Management practices for Additional/Alternative to Existing Surface Water Supply Sources (ASWS) were renumbered and categorized to high priority, medium priority and low priority management practices.<br>• Management practice MWWPC-1 (Increase Wastewater Capacity) was removed. |
| 7 | Section 7.4 | Text revisions/updates | • The text was updated to identify changes since 2011.<br>• In 2016, the Agricultural metering program was moved out of GS&WCC and into EPD. |
| 8 | Table 8-1 | Updated | • Table was modified to be consistent with Table 6-1.<br>• Management practices for Additional/Alternative to Existing Surface Water Supply Sources (ASWS) were renumbered and regrouped.<br>• Revised management practice numbers for DCAR because former DCAR-7 was removed.<br>• Reference to management practice MWWPC-1 (Increase Wastewater Capacity) was removed. |
| General updates completed throughout the plan | | Updated references to “Upper Floridan” aquifer to read “Floridan” aquifer. | • References to the “Upper Floridan” aquifer were updated to read “Floridan,” to ensure consistency with terminology used by EPD in the 2013 Announcement regarding Future Withdrawals from the Floridan Aquifer and in other documents. |
| | | Removed references to the current State Water Plan or Council webpages (instead referring to availability on the Council’s website of the Water Planning website). | • EPD is currently working to build a new Regional Water Planning website. Once the new site is up, the former site will be taken down. Web links in the Regional Water Plan document will be updated once the new website is completed. |

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